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Vol. IV JANUARY, 1917 No. 1

BOSTON SOCIETY OF CIVIL ENGINEERS

FOUNDED 1848

PROCEEDINGS

NOTICE OF REGULAR MEETING.

A REGULAR meeting of the Boston Society of Civil Engineers will be held on

WEDNESDAY, JANUARY 24, 1917,

at 8.00 o'clock P.M., in CHIPMAN HALL, TREMONT TEMPLE, BOSTON.

Past-President Desmond FitzGerald will exhibit some of his colored lantern slides of travel and explain them in an interesting talk.

The Committee on Social Activities has arranged for a supper, to be served in Chipman Hall for members and their ladies, before the meeting. A special notice will be sent out later.

S. E. TINKHAM, *Secretary.*

PAPER IN THIS NUMBER.

"Catch-Basin Construction and Maintenance." Topical discussion.

CURRENT DISCUSSION.

Paper.	Author.	Published.	Discussion Closes.
"The Portland Bridge."	E. E. Pettee.	Dec.	Feb. 10

Reprints from this publication, which is copyrighted, may be made provided full credit is given to the author and the Society.

Contributors are hereby notified that proof will not be submitted to them for examination unless requested before the 10th of the month preceding the month of publication.

BINDING SOCIETY JOURNAL.

THE Secretary has made arrangements for binding Volume 3 of the JOURNAL of the Society. The ten numbers will be bound in one volume, the style of binding to be uniform with that of Volumes 1 and 2. Because of the increased cost of material, the price of binding this year will be 80 cents per volume.

Numbers for binding must be sent to 715 Tremont Temple, Boston, before March 1, 1917, in order to be bound at the price named.

MINUTES OF MEETINGS.

BOSTON, MASS., December 20, 1916. — A regular meeting of the Boston Society of Civil Engineers was held this evening in Chipman Hall, Tremont Temple, and was called to order at 8.20 o'clock by the President, Richard A. Hale.

There were present 55 members and guests.

The record of the last meeting was approved as printed in the December JOURNAL.

The President reported for the Board of Government the election of the following to membership in the Society in the grades named:

Members — Messrs. William Allen Bryant, Arthur William Knowlton, Conrad Nolan and Erving Mandeville Young.

Associate — Mr. Charles Edward Kingston Fraser.

Juniors — Messrs. Anthony Andrew Breen, Alexander Bresth, Charles Leavett Crosier, Ray Osborn Delano and Henry Elmer Strout, Jr.

The President announced the deaths of the following members of the Society:

William H. Jaques, died November 23, 1916; Harold Parker, died November 29, 1916; and Edmund B. Weston, died December 9, 1916.

By vote, the President was requested to appoint committees to prepare memoirs.

The President has named the membership of these committees as follows:

On memoir of William H. Jaques, Prof. Ira N. Hollis; on memoir of Harold Parker, Messrs. Arthur W. Dean, William E. McClintock and Frederic W. Bateman; on memoir of Edmund B. Weston, Mr. Otis F. Clapp.

Mr. E. M. Blake brought to the attention of the Society the desirability of a committee to collect information and report on the best figures of run-off in New England which are available for water-power purposes. He moved the following resolution: "Resolved that the President be and hereby is authorized to appoint a committee to collect, compile, analyze and report upon the best figures of run-off in New England which are available for water-power purposes."

The resolution was adopted by a unanimous vote. The President has appointed, as the committee authorized by the resolution, Messrs. Arthur T. Safford, chairman; Harold S. Boardman, X. Henry Goodnough, Richard A. Hale, Chas. H. Pierce, George E. Russell, Charles W. Sherman, Herbert A. Moody, W. Frank Uhl, Joseph F. Wilber and Dana M. Wood.

The President then introduced Mr. Arthur E. Morgan, president of the Morgan Engineering Companies, of Dayton, Ohio, who read a most interesting paper entitled, "Flood Control in the Miami Valley." The paper was very fully illustrated by lantern slides. At the conclusion of the paper a short discussion took place, in which Mr. E. S. Dorr, President Hale and Past-President Eddy participated.

After passing a unanimous vote of thanks to Mr. Morgan for his very interesting paper, the Society adjourned.

S. E. TINKHAM, *Secretary.*

BOSTON, MASS., December 27, 1916. — A special meeting of the Sanitary Section, Boston Society of Civil Engineers, was held this evening in the Society Library, Tremont Temple.

The meeting was opened at 7.45 by the vice-chairman, Edward Wright, Jr.

The minutes of the December meeting were read and approved.

The speaker was Mr. Theodore R. Kendall, engineer in charge, who gave a very interesting talk on "The Agua Clara Filtration Plant at Gatun, C. Z." Illustrations by lantern slides added to the value of the description.

Voted : To extend the thanks of the Section to Mr. Kendall for giving the address of the evening.

There were 29 present. Meeting adjourned at 9.15 o'clock.

FRANK A. MARSTON, *Clerk.*

APPLICATIONS FOR MEMBERSHIP.

[January 4, 1917.]

THE By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of twenty (20) days from the date given.

BARRY, CHARLES GARDNER, Sandwich, Mass. (Age 39, b. Melrose, Mass.) Student at Mass. Inst. of Technology, 1895–1900, civil engineering course. From June, 1900, to September, 1905, rodman, instrumentman, inspector, etc., with B. & M. R. R.; from September, 1905, to March, 1906, with N. Y. C. & H. R. R. R. on grade-crossing elimination, etc.; from March, 1906, to June, 1909, instrumentman on Penn. R. R. tunnels; from June, 1909, to March, 1910, with N. Y. C. & H. R. R. R. on surveys and estimates for tunnel and dam; from April, 1910, to November, 1914, with Cape Cod Construction Co., in charge of field party and main office drafting room; since fall of 1915, of firm of Barry & Gurney, engineers and surveyors, Buzzards

Bay, Mass. Refers to A. S. Ackerman, C. B. Breed, J. J. Rourke, and C. M. Spofford.

Boas, Benjamin, Dorchester, Mass. (Age 26, b. Boston, Mass.) Graduate of Lowell Institute, 1910. During 1909 with Whitman & Howard, civil engineers; from 1910 to 1912 with Metropolitan Water Board, Engineering Department; from 1912 to 1914 resident engineer on construction work with Goodyear Tire & Rubber Co. of Akron, Ohio; during 1915 with Mass. Harbor & Land Commission, engineering department; is now resident engineer on construction work with Monks & Johnson. Elected a junior, October 16, 1912, and now desires to be transferred to grade of member. Refers to L. B. Ellis, Clifford Foss, W. E. Foss and Mark Linenthal.

Burnes, George Robert, Revere, Mass. (Age 26, b. Salem, Mass.) Graduate of Mass. Inst. of Technology, 1913, civil engineering course. From June to October, 1913, transitman with City of Chelsea, Mass.; from October, 1913, to 1914, in Boston office of Concrete Steel Company; from 1914 to date, assistant city engineer and superintendent of Street Division, Revere, Mass. Elected a junior, April 15, 1914, and now desires to be transferred to grade of member. Refers to C. F. Allen, C. B. Breed, J. A. O'Brien, C. G. Richmond and C. M. Spofford.

Clarkson, Edward Hale, Jr., Cambridge, Mass. (Age 23, b. Auburndale, Mass.) Graduate of Mass. Inst. of Technology, 1915, sanitary engineering course, degree of S.B. Is now assistant in civil and sanitary engineering department, Mass. Inst. of Technology. Refers to H. K. Barrows, C. B. Breed, J. W. Howard, Dwight Porter, C. M. Spofford and G. C. Whipple.

Jerome, Frank Jay, Toledo, Ohio. (Age 26, b. Painesville, Ohio.) Graduate of Mass. Inst. of Technology, 1914, civil engineering course, degree of S.B. From July, 1914, to date, with N. Y. C. R. R., line west of Buffalo; is now assistant engineer in resident engineer's office, Toledo, Ohio. Elected a junior, May 21, 1913, and now desires to be transferred to grade of member. Refers to C. F. Allen, C. B. Breed, A. E. Burton and C. M. Spofford.

Mattson, William Rhoads, Brookline, Mass. (Age 26, b. Philadelphia, Pa.) Graduate of Mass. Inst. of Technology, 1913, civil engineering course, degree of B.S. During summers of 1910, 1911 and 1914, fourteen months in all, rodman, transitman and chief of party with Brookline Engineering Department; during winter of 1914–15 made engineering and economic study of wages and living conditions for Bay State St. Ry. Co., under direction of A. S. Richey; during summer of 1915, chief engineer on two construction jobs for Aberthaw Construction Co.; with Mass. Highway Commission for four months in 1912 as transitman and chief of party; for nine months in 1913 and four months in 1915, as engineer in Maintenance Dept.; and for nine months, to date, as resident engineer on construction work. Refers to A. E. Burton, R. W. Coburn, A. M. Lovis, A. P. Rice, G. P. Soutar, C. M. Spofford and A. E. Tarbell.

Monaghan, John E. L., Boston, Mass. (Age 39, b. Oldham, England.) Graduate of Mass. Inst. of Technology, 1906. From 1906 to 1915, assistant engineer; during 1915, assistant district engineer, and from 1916 to date, district engineer with City of Boston. Refers to T. F. Bowes, J. E. Carty, C. H. Dodd, E. S. Dorr, D. P. Kelley and J. M. McNulty.

Nash, Philip Curtis, Watertown, Mass. (Age 26, b. Hingham, Mass.) Graduate of Harvard University, 1911, degree of A.B.; and of Harvard Graduate School of Applied Science, 1912, degree of M.C.E. From 1911 to 1912 with Boston Transit Commission on subway construction; is now assistant engineer with Boston Transit Commission on construction of Section G of Dorchester Tunnel. Elected a junior January 22, 1913, and now desires to be transferred to grade of member. Refers to E. S. Davis, W. W. Davis, F. C. H. Eichorn, G. D. Emerson, L. B. Manley and G. F. Swain.

Simons, George W., Jr., Jacksonville, Fla. (Age 25, b. Portland, Ore.) Graduate of Beloit College, 1912, degree of B.S.; graduate of Mass. Inst. of Technology, 1915, sanitary engineering course. From July to September, 1913, draftsman with Aetna Engineering Bureau, Chicago; during summer of 1915, assistant to Prof. G. C. Whipple, Harvard University; during 1915–16, assistant in civil engineering department, Mass. Inst. of Technology; from July, 1916, to date, chief, Bureau of Sanitary Engineering, Florida State Board of Health. Elected a junior, January 27, 1915, and now desires to be transferred to grade of member. Refers to H. K. Barrows, Dwight Porter, C. M. Spofford, R. S. Weston and G. C. Whipple.

LIST OF MEMBERS.

ADDITIONS.

Crosier, Charles L..................316 Huntington Ave., Boston, Mass.
Fraser, Charles E. K..................................Peterboro, N. H.
Young, Erving M...................380 West Main St., Waterbury, Conn.

CHANGES OF ADDRESS.

Clark, Frank W...................10 Lynnfield Parkway, Melrose, Mass.
Hubbard, Carl P.................................New Milford, Conn.
Hurd, Stephen P.................247 West Main St., East Aurora, N. Y.
Johnson, Eric L........................23 Irma Ave., Watertown, Mass.
Kendall, Theodore R...............93 Gainsborough St., Boston, Mass.
Klink, Nassime S......................Care Aberthaw Construction Co.,
Water and Chestnut Sts., New Haven, Conn.
Shaw, Arthur L......................967 Robeson St., Fall River, Mass.
Smith, Chester W....................208 Granite St., Manchester, N. H.
Smulski, Edward.................2501 Park Row Bldg., New York, N. Y.
Von Loesecke, Sidney S.
Automobile Legal Association, 6 Beacon St., Boston, Mass.

DEATH.

Weston, Edmund B...............................December 9, 1916

EMPLOYMENT BUREAU.

The Board of Government maintains an employment bureau for the Society, to be a medium for securing positions for its members and applicants for membership, and also for furnishing employees to members and others desiring men capable of filling responsible positions.

At the Society room two lists are kept on file, one of *positions available* and the other of *men available*, giving in each case detailed information in relation thereto.

Men Available.

No. 384. Age 40. Tufts College, class of 1898. Has had seventeen years' experience, including two years in city engineer's office, Everett, Mass.; three and one-half years with Metropolitan Water Board on Wachusett Reservoir; two years with Bureau of Sewers, Brooklyn, N. Y.; six and one-half years with New York Board of Water Supply on Catskill Aqueduct; two years as superintendent for engineering firm in New York City on large sewer work in Bronx; and one year as engineer and superintendent on docks, pile driving and sewer outlets. Desires position as engineer or superintendent of construction. Salary desired, $200 per month.

No. 385. Age 30. Student for three years at Harvard University, Lawrence Scientific School, class of 1907. Has had experience as rodman, leveler and topographer on railway surveys in Arizona; as transitman in charge of lines and grades on subway construction for Boston Elevated Railway Co.; as transitman on construction of Cape Cod Canal; as inspector for Boston Transit Commission on Dorchester Tunnel; and as assistant engineer on farm reclamation and general land surveys for United Fruit Co., Panama.

No. 386. Age 26. High-school education. Has had eight years' general experience as surveyor and draftsman, including seven years on high-tension transmission lines, water-power development, highways, etc.; six months as chief of party on surveys for water-works system; and six months as chief of party on valuation work for Rhode Island Company. Desires position as chief of party, transitman or draftsman. Salary desired, $18 per week.

No. 387. Graduate of Technical High School and I. C. S. student in civil engineering. Has had three and one-half years' experience as rodman, transitman, draftsman and chief of party on railroad and municipal work. Desires position as transitman. Salary desired, $15.

LIBRARY NOTES.

Recent Additions to the Library.

U. S. Government Reports.

Annual Report of Governor of Panama Canal for 1915–16, with Maps and Diagrams.

Barytes and Strontium in 1915. James M. Hill.

Flow of Water in Wood-Stave Pipe. Fred. C. Scobey.

Gold, Silver, Copper, Lead, and Zinc in California and Oregon in 1915. Charles G. Yale.

Iron Ore, Pig Iron and Steel in 1915. Ernest F. Burchard.

Mineral Waters in 1915. Richard B. Dole.

Phosphate Rock in 1915. W. C. Phalen.

Quicksilver in 1915. H. D. McCaskey.

Spirit Leveling in Texas, 1896 to 1915, inclusive. R. B. Marshall.

Water-Supply Papers 362-A, 381, 382, 415.

State Report.

Ohio. Official Plan of Miami Conservancy District for Protection of District from Flood Damage, Vols. I and III.

Municipal Reports.

Lynn, Mass. Annual Report of Commissioner of Water Works for 1915.

North Shore Sanitary District, Lake County, Ill. Report of Board of Engineers, 1916.

Philadelphia, Pa. Annual Report of Bureau of Surveys for 1915.

Miscellaneous.

American Society for Testing Materials: Proceedings for 1916, 2 vols.

Chemins de Fer. Amédée Guillemin. Gift of E. C. Sherman.

Electric Railways. Robert Luce. Gift of H. S. Knowlton.

Maintenance of Way and Structures. William C. Willard.

Municipal Index, August, 1912, to December, 1915.

Passenger Terminals and Trains. John A. Droege.

The duplicates listed below have been placed on the ends of the tables in the reading-room, and members are invited to help themselves.

American Society for Testing Materials: Proceedings, 1914–15, 4 vols., one bound in cloth.

American Society of Civil Engineers: Proceedings, January–April, August–October, 1912; January, April, September, October, December, 1913; January–April, August, September, 1914; Transactions, December, 1914.

Boston, Mass.: Annual Reports of Public Works Department for 1911, 1913, 1914; Annual Reports of Street Department for 1892, 1910; Annual Report of Street Laying-out Department for 1896; Annual Reports of Transit Commission for 1895, 1896, 1901.

Cambridge Bridge Commission's Report, 1909, 2 copies.

Chicago, Ill.: Report on Diversion of Waters of Great Lakes by Way of Sanitary and Ship Canal of Chicago. Lyman E. Cooley. 1913.

Connecticut: Annual Reports of Railroad Commissioners for 1896–98, 1900–1911; Annual Report of Public Utilities Commission for 1914.

Electric Railway Journal: December 4, 1915; February 19, 1916.

Engineering Magazine: Vol. 1, April–September, 1891, bound; October, 1909; Vol 43, April–September, 1912, complete; December, 1914; January, March, May, 1915.

Interstate Commerce Commission: Annual Reports for 1900–1911.

Manual of Topographical Drawing. Lieut. R. S. Smith. 1856.

Massachusetts: Special Report of Railroad Commissioners on Bussey Bridge Investigation, 1887; Annual Reports of Railroad Commissioners for 1877 (Part 2); 1880–84; 1886–90; 1892–95; 1896–1912; Annual Reports of State Board of Health for 1894; 1911–12.

Municipal Journal: August 12, September 23, 1915; January 6, 1916.

New York: Annual Reports of Public Service Commission for First District for 1910, 1911, 1912 (Vols. 1 and 3), 1914 (Vol. 2); Annual Reports of State Engineer and Surveyor for 1910–12.

Pennsylvania: Annual Report of Water Supply Commission for 1913.

Pittsburgh, Pa.: Report of Flood Commission, 1911.

Treatise on Resistance of Materials. De Volson Wood. 1871.

U. S. War Department: Wave Action in Relation to Engineering Structures. Capt. D. D. Gaillard. 1904.

LIBRARY COMMITTEE.

NEW ENGINEERING WORK.

(Under this head a brief description of new engineering work contemplated or under construction will be presented each month. Engineers and contractors are requested to send descriptions of their work to the Secretary, 715 Tremont Temple, Boston, before the 1st of each month.)

United States Government. — NAVY DEPARTMENT. — *Navy Yard, Boston.* — Work being done consists of a dry coursed rubble sea wall at the Naval Hospital, Chelsea, Mass.

Work proposed consists of the installation of two 2 500 cu. ft. air compressors, compressors now on hand.

Commonwealth of Massachusetts.—METROPOLITAN WATER AND SEWERAGE BOARD. — *Sewerage Works.*

Wellesley Extension High Level Sewer: Sects. 98 and 102, in progress; Sect. 103, completed; Sect. 104, nearly completed.

New work is contemplated as follows: Reading extension; Sects. 99–101, Wellesley extension.

METROPOLITAN PARK COMMISSION. — The following work is in progress:

Charles River Reservation. — Building reinforced concrete bridge over the Charles River at North Beacon St., Boston and Watertown. A. G. Tomasello, contractor.

Mystic Valley Parkway. — Grading extension of Mystic Valley Parkway from Mystic St. to Medford St., Arlington. James H. Fannon, contractor.

Old Colony Parkway. — Plans and specifications are being prepared for bridge over the Neponset River, Boston and Quincy, to replace old wooden bridge. Bids to be called for about the first of the year.

Boston Transit Commission. — *Dorchester Tunnel.* — The Dorchester Tunnel has been practically completed from its beginning at Tremont St. to a point under Dorchester Ave. near Broadway in South Boston.

Work is progressing on the Broadway Station, which extends in Dorchester Ave. from Broadway to West Fourth St. The T. A. Gillespie Co. is the contractor.

Work on Section G, which extends in Dorchester Ave. from West Fourth St. to Old Colony Ave., is in progress. Coleman Brothers are the contractors.

Section H and Section H Extension, which are completed, extend in Dorchester Ave. from Old Colony Ave. to near Dexter St.

The next section, Section J, extending from a point near Dexter St. in a southerly direction in and near Dorchester Ave. and Boston St. to near Ralston St., and embracing the station in Andrew Sq., is being constructed. The T. A. Gillespie Co. is the contractor.

The relaying of the granite-block paving, with grout joints and on a concrete base, in Dorchester Ave. from Old Colony Ave. to Humboldt Pl. near Andrew Sq., has been interrupted by the severely cold weather and will be resumed as early in the season as the weather will permit. The T. A. Gillespie Co. is the contractor.

New York, New Haven & Hartford R. R. Co. — *Boston, Mass., Southampton Street Engine Facilities.* — Work consists of new 39-stall engine house, 95-ft. turntable, ash pits, boiler house, office building, water tank and necessary trackage.

During past month have been excavating for engine house, office building and turntable foundations; driving concrete piles for engine house and wooden piles for turntable; erecting temporary building, etc.

Vol. IV JANUARY, 1917 No. 1

BOSTON SOCIETY OF CIVIL ENGINEERS
FOUNDED 1848

PAPERS AND DISCUSSIONS

This Society is not responsible for any statement made or opinion expressed in its publications

CATCH-BASIN CONSTRUCTION AND MAINTENANCE.

FOLLOWED BY BIBLIOGRAPHY.

(Topical Discussion presented before the Sanitary Section, November 1, 1916.)

BY GEORGE A. CARPENTER, LEWIS M. HASTINGS, EDGAR S. DORR, GEORGE H. NYE, DAVID A. AMBROSE, PHILIP W. TAYLOR, GORDON H. FERNALD, HENRY A. VARNEY, WM. A. BROWN, EDWIN H. ROGERS, W. L. VENNARD, FRED R. CHARNOCK, WALTER E. NOBLE, JOHN H. GREGORY, FRANK A. MARSTON, AND MISS M. E. EVANS.

MR. GEORGE A. CARPENTER.* — Shakespeare and catch-basin construction may seem to be widely different subjects, but Hamlet's soliloquy has been so often parodied that perhaps one more attempt may be pardoned. At any rate, the speaker thought he saw another application and could not resist the temptation to take his try at it.

> Catch basin or inlet, — that is the question;
> Whether 'tis better for the mind to favor
> The building, care and maintenance of basins,
> Or to take arms against this sea of troubles,
> And just build gutter inlets? To dare to clean
> No more: — and by that act to say we end
> The nuisance, and the many natural shocks
> These basins give us; 'tis a consummation

NOTE. Further discussion of this subject is invited, to be received by the editor before March 10, 1917, for publication in a subsequent number of the JOURNAL.

* City Engineer, Pawtucket, R. I.

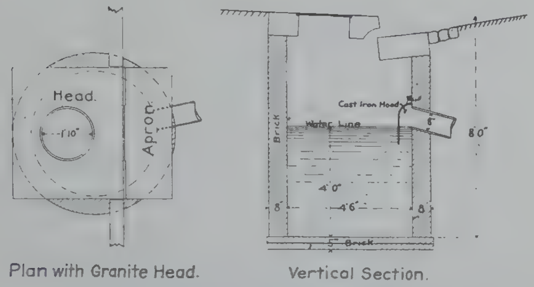
Devoutly to be wished. To act, — to sleep: —
To sleep; perchance to dream; ay, there's the rub;
For in that peaceful sleep what dreams may come
After we have filled all those old basins
Must give us pause. This is the thought
That makes us hesitate in building inlets;
For who would bear the gibes and jeers of men
Caused through mistake, the proud man's contumely,
The pangs of anxious doubt, results delayed,
The politician's keen, exhaustive search
That patient bides such opportunity,
When he, himself, might his contentment have
By simply building basins?

With most of us, however, the catch basin is here to stay, — at least for some time to come, — and demands regular, systematic inspection and cleaning. How to accomplish this in the most satisfactory and economical way is the problem under discussion.

For years the speaker has worked, on various occasions, to discover some *form* of basin construction that would lend itself to better and more economical cleaning methods, or to originate some more satisfactory way of cleaning the type of basin already constructed. Up to within a very short time, however, he had discovered no method of cleaning that seemed any better than the one quite generally adopted, of sending a man into the basin to shovel its contents into a bucket which is then raised and dumped into a cart by men at the surface. This method has always appeared crude and unsatisfactory, especially the sending of a man into a wet, dirty basin to bail out the water, and work, some of the time at least, in very cramped quarters.

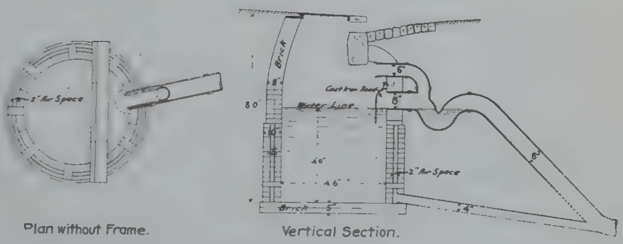
About two years ago men in the employ of the city of Pawtucket developed the idea of combining a power hoist with an automobile truck, for carting away catch-basin detritus, and out of this idea gradually grew the more perfect cleaning apparatus now in use in that city. Before describing this, however, it may be of interest to discuss the form of the basin itself.

When the construction of a sewer system was begun in Pawtucket, over thirty years ago, the type of basin adopted was that shown by Fig. 1. This was the type used at that time in



Plan with Granite Head. Vertical Section.

FIG. I. CATCH BASIN



Plan without Frame. Vertical Section.

FIG. 2. CATCH BASIN WITH DRAINAGE SPACE

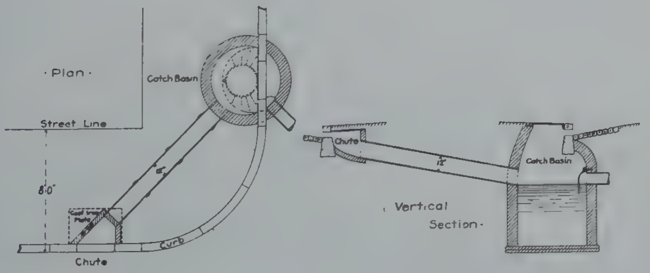


FIG. 3. CATCH BASIN AND INLET

PAWTUCKET, R. I.

the neighboring city of Providence, except that the Providence basin was built with a stone slab for the bottom, while in Pawtucket the bottom was constructed of two courses of bricks laid flat. This basin was covered with a heavy, granite head and gutter-stone which cost about $25.00 per set and which required the use of a derrick for setting.

An ordinary, oven-door trap was first used to cut off the sewer gases, but this required that the basin be filled with water to the overflow line to be effective. A few years later the Coleman trap was invented and placed upon the market, and was extensively used in Providence, Pawtucket and many other places.

The main claim made for the Coleman trap is the great saving of water used for trapping the basin after cleaning, and its more permanent water seal. It has been the speaker's experience, however, that there are several practical disadvantages which more than offset the economical feature claimed. The inlet to the trap is small and so constructed that small sticks, leaves and other floating matter readily enter and often produce a complete stoppage. Where frozen slush enters a basin in the winter season this form of trap is more easily clogged and less easily relieved than the old oven-door trap which can be yanked open in an emergency and be made to give instant relief to clogged conditions.

As experience brought out these objectionable features they were partially overcome by the addition of a galvanized-iron hood which protected the opening to the trap. Many traps were thus equipped, but so much difficulty was still experienced that these traps were eventually removed and plain cast-iron hoods were substituted. It is only fair to state, however, that these traps are still used and thoroughly approved by the Providence officials.

Most engineers have ideas which they attempt to work out from time to time in an effort to accomplish some specific purpose, and some of the speaker's will be referred to.

In an effort to overcome the objectionable features alluded to, some basins were constructed after the following designs:

A regular S-trap (Fig. 2) was placed in the connection just outside the basin, and was ventilated into the top of the basin to prevent syphoning. This connection also provided an additional outlet in case of any obstruction at the hood, or where the basin had been neglected and had become filled with dirt to above the hood level. The inlet to the trap was protected from floating sticks and leaves by a hood. The few basins of this type which were built have been in use for a dozen years, or more, and have never given any trouble, so far as the speaker has been able to ascertain by repeated inquiry of the cleaning gang.

Another form of basin (Fig. 2) designed to do away with bailing, and to produce drier material for easier handling, was built as follows:

The two courses of the lower portion of the basin were separated by a two-inch space and the inner ring was built of soft, porous bricks. The space between the courses was drained by a connection to the main outlet pipe of the basin. The inspector of basins informed the speaker, a short time ago, that the contents of these basins were always much drier than the contents of other types of basins and also stated that the S-trap held the water seal much better than other forms of traps. Before indorsing the above opinion, however, the speaker would wish to make a personal inspection and study of conditions.

A great improvement in catch-basin construction was made when Providence adopted, about 1905, a form of cast-iron head and curbstone inlet, which reduced the cost and did away with the heavy granite head and gutter-stone. The speaker considers that, in his observations and experience, he has never found a better or a neater catch-basin head than this (Fig. 3). The inlet is made by cutting an opening through the curbstone, and nothing but a light, iron cover about two feet in diameter shows on the surface of the sidewalk.

Another detail which has proved more or less of a nuisance to the comfort of the pedestrian is the corner basin. In the earlier days an attempt was made to economize by constructing one basin instead of two at sidewalk intersections and locating it at the intersection of the curb lines. This form of construction may have been more economical but it made necessary a deep gutter through the cross-walk. To-day we avoid stepping across a full flowing gutter by better basin locations and designs.

At sidewalk intersections only one basin is built, as formerly, but this is located above the cross-walk (Fig. 3), and in the adjacent curb of the intersecting street an additional inlet or chute is constructed with a pipe leading under the sidewalk to the basin. It has not been necessary to abandon corner basins already constructed to accomplish the same result. Where they exist and it is desired to improve conditions, the old entrance to the basin can be closed and simple chutes, or inlets, can be constructed on each street and connected, under the sidewalk, with the old basin.

When planning catch-basin openings and connections, the speaker has often felt the lack of sufficient data relative to the approximate amount of storm-water that will pass a given opening in the curb, and also the maximum quantity that will pass the form of trap and connection used. Inlets through the curb, of the form illustrated, generally measure about 4 ins. x 24 ins., 4 ins. x 30 ins. or 4 ins. x 36 ins. as the location seems to demand. Eight, ten or twelve-inch pipes are used for connections between the basin and the sewer, as the engineer's judgment dictates. The speaker raises the question, would it not be well to have more definite data than we at present possess, respecting the relative capacity of various inlet openings, traps and sewer connections? Investigations along this line might be made with profit.

MAINTENANCE.

Unless some systematic inspection of catch-basins is maintained, the cleaning gang may spend its time bailing out three feet of water to remove one foot of dirt instead of attending to those basins only which contain sufficient dirt to warrant cleaning.

A number of years ago the speaker developed a system of inspection and records which enabled written directions to be given the cleaning gang, informing it just what basins to clean, the order in which the work was to be performed and requiring written reports of the work accomplished to be returned to the office. By this means a record of the work performed, the amount of material removed from each basin and the costs per cubic yard were obtained.

As frequently happens in municipal affairs, however, changes in administration occurred, the newness of the system wore off, it began to run itself and costs began to soar. The story is told of how the cleaning gang at one time developed a method of fooling one of the inspectors employed to see that the cleaning was properly performed. It was the custom of this inspector to drive up to the curb near the basin and ask if it had been completely emptied. Receiving an affirmative reply, he would request that a stone be dropped into the basin and the sound of the stone striking the bottom assured him of the correctness of the report without the bother and exertion of a more careful inspection.

Upon finding this method was becoming a common practice with this inspector, some bright member of the gang evolved the scheme of removing only a part of the contents of the basin and then digging a hole down to the bottom in the center of the remainder. Then, resting from its labor, the gang was ready for the inspector's visit and, when he appeared in sight, was gathering up its tools preparing to depart for the next basin needing attention. Upon being asked the usual question as to whether the basin was cleaned the gang always answered in the affirmative and in proof of its statement promptly dropped a stone into the basin. Going down through the hole excavated in the center the stone stuck the bottom and gave forth the proper sound, whereupon the work received approval and was properly recorded upon the inspector's report cards, which were later sent to the office. Of quite equal value, the speaker imagines, may be many of the so-called *statistics* which engineers review in the course of their work.

During the speaker's experience, he has often had visions of reducing the cost of catch-basin cleaning, and has spent hours trying to work out some form of basin construction which would contribute to this end. His schemes have varied all the way from buckets, or tubs, in the basin, which could be hoisted to the surface when full and dumped directly into a cart, to a small ladder dredge working through the cover, or through a specially designed opening. All these schemes have ultimately led to the conclusion that any cleaning device, to be practicable, must be adaptable to the present form of basin, as there are too many basins in use to think of general reconstruction.

Pawtucket feels it has recently produced a type of cleaning truck that accomplishes the purpose sought. In its present state it is the result of practical experience on the job, and considerable improvement has been made over the original design. Starting with a simple, self-dumping, auto truck equipped with a power-operated hoist, a water pump and orange-peel bucket hydraulically controlled have been added, and now the city has a machine equipped for the practical and rapid cleaning of basins at a greatly reduced cost.

Catch-Basin Cleaning Truck.

The truck consists of a Standard chassis with a 32 h.p. engine. On this is mounted a steel body made by the Monahan Vehicle Company, of Providence, R. I., which measures about 9 ft. by 4½ ft. by 2⅓ ft. high and has a capacity of 3.4 cu. yds. Cover plates 2 ft. wide are placed over each end to prevent the slopping of the load. (Fig. 4.) The average load has measured about 2.6 cu. yds. and weighed about 3.4 tons.

The tailboard is hinged at the top, provided with a rubber gasket, and can be clamped tightly against the body. The body is provided with a hydraulic lift operated from the transmission system of the engine. A pair of 6-in. I-beams are mounted on the chassis back of the driver's seat, and on these I-beams is mounted the 2 h.p. Fairbanks & Morse gasoline engine and the cable-drum and control mechanism. The cable runs to an outrigger which can be swung over the catch basin and back over the cart after the bucket is raised and ready to dump. A 4 h.p. engine is to be substituted for the original 2 h.p., as the first engine was found lacking in power for the most efficient work.

The first bucket provided for this truck was a plain, cylindrical one 14 ins. in diameter and 17 ins. deep, with a capacity of 1½ cu. ft. It was filled by hand by a man in the basin, after the manner of the regular cleaning methods then in use. After operating this equipment from July until November, 1913, an orange-peel bucket controlled and operated by oil under a pressure of about 100 lbs. per sq. in. was substituted. (Fig. 5.) Experiments have recently been made with compressed air in place of oil, which indicate that the time of loading can be materially reduced by this means, and it is probable that compressed air will be substituted for the oil.

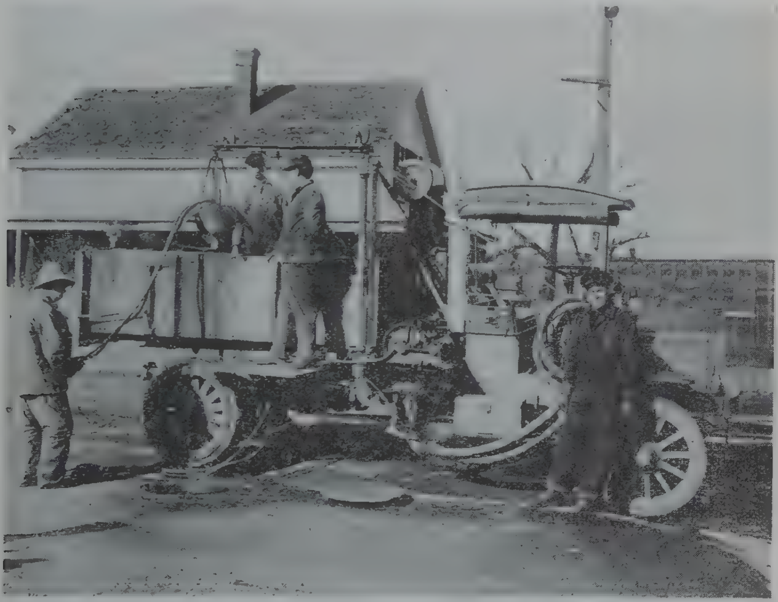


FIG. 4. CATCH-BASIN CLEANING TRUCK, PAWTUCKET.

When the truck was first put in operation with a bucket loaded by hand, its average output was 5 loads, or 13 cu. yds. per day of nine hours. With the orange-peel bucket this output was increased to 9 loads, or 23.4 cu. yds. per day. Experiments with compressed air indicate that this can be increased to 12 loads, or 31.2 cu. yds. per day.

In February, 1916, a test was made with compressed air, and the following data were obtained while cleaning four basins. At the first basin 25 cu. ft. of soft material were taken out in four minutes. The truck was moved to a second basin in five minutes and 50 cu. ft. were added to the load in twelve minutes more. This gave a load of 75 cu. ft. in twenty-one minutes, or sixteen minutes of actual loading time. The truck was then taken to a dump 6 200 ft. distant and returned to a third basin 6 600 ft. from the dump in eighteen minutes, — a rate of 8.07 miles per hour. In two minutes more the truck was located over this basin and took out 65 cu. ft. of hard material in twenty minutes. It was moved 500 ft. to a fourth basin in seven minutes and in four minutes had added 15 cu. ft. to its load and started for the dump 6 700 ft. away. It dumped its load and returned to the starting-point in twenty minutes.

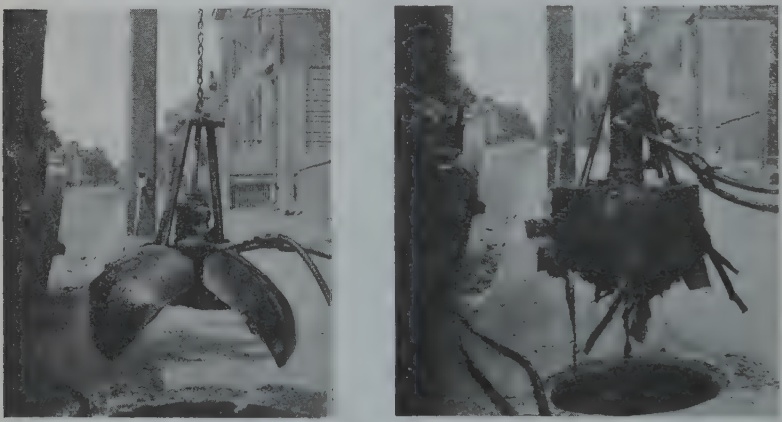


Fig. 5. Orange-Peel Bucket of Cleaning Truck.

The above indicates that 155 cu. ft., or 5.75 cu. yds., were moved to a dump $1\frac{1}{4}$ miles distant in one hour and thirty-three minutes, an average of a load of 2.87 cu. yds. in forty-six and one-half minutes. The average loading time was seven minutes per cu. yd., and the speed to the dump, a little over 7 miles per hour.

Figures made in 1897 gave an average time for loading by the old method of forty minutes per cubic yard and an average time for hauling of thirty-five minutes for 3 500 ft., or 1.13 miles per hour.

It seems reasonable to predict an average of one load of 2.6 cu. yds. every forty-five minutes to a dump 1¼ miles distant when the compressed air attachment shall have been made, and, using this figure for an average daily output, 3.466 cu. yds. per hour, we may approximate the total cost per cubic yard as follows:

Approximate Cost per Cubic Yard of Cleaning Basins, Based on a Year of 40 Weeks, or 1 920 Hours.

Overhead Charges.	Cost per Hour.
Interest at 4 per cent. on approximate cost of truck ($4 200.00), or $168.00 ÷ 1 920 =	$0.087
Depreciation and repairs at 20 per cent., or $840.00 ÷ 1 920 =	0.437
Tires — one set of rear tires and one-half set front tires, $250.00 ÷ 1 920 =	0.130
Labor — 3 men at $12.00 per week, 1 man at $16.00 = $52.00 ÷ 48.00 =	1.083
	$1.737
$1.737 ÷ 3.466	$0.50 per cu. yd.
Cost of gasoline ($112.00), oil and grease ($14.70) for 1 474 cu. yds. of actual work = $126.70 or	0.086 " " "
Double this to allow for increase in price =	0.17
Total cost	$0.75 per cu. yd.

The following table represents some of the figures obtained from the older inspection and cleaning methods referred to.

TABLE 1.

Cost of Catch-Basin Cleaning at Pawtucket, R. I.

Year.	Basins Cleaned.	Loads Removed per Basin.	Cubic Yards per Load.	Cost per Cu. Yd.	Average Length of Haul in Ft.	Cost per Cu. Yd. on Basis of Wages Paid in 1915.
1897	1 155	1.84	0.824	$0.765	2 260	
1898	1 694	1.95	0.90	0.70	2 780 ±	
1899	1 233	1.92	0.96	0.66	2 500 ±	
1900	1 271	2.11	1.00	0.68	2 600 ±	
1901	902	2.55	0.74	0.737		$0.964
1902	563	2.53	0.75	0.920		1.07
1903	1 063	2.48	0.72	1.04		1.21
1904–5	1 162	2.20	0.77	1.058		1.23
1907	1 213	2.17	0.817	1.34		1.56
1908	1 404	1.95	0.89	1.55		1.804
1909	992	2.01	0.84	1.55		1.804

Mr. L. M. Hastings.* — Cambridge has been building catch basins for quite a while — the first of which there is any record having been built in 1850. It might therefore be of interest to trace the progressive steps taken in building the different types from that date to the present time.

Fig. 6 shows one of the older types that were built in the early days. It was built of bricks and "natural" or Rosendale cement with a short curbstone at the sidewalk line and a granite "bar stone" forming a trap or water seal. The top opening had a stone frame in which was set a 3-in. oak cover 2 ft. 4 ins. square. The bar stone was set across a little alcove or extension of the basin from which the outlet led to the sewer.

These basins were elliptical in plan, being about 6 ft. in longitudinal diameter and 5 ft. transversely, and 7 ft. from curb to the bottom, holding about 3 ft. in depth of material. The throat or inlet was cut in the face of the curb and was about 20 ins. long. There were many objections to this type. The covers, being of wood and in the gutter, decayed rapidly and were a constant source of danger to horses and of expense for renewals; also the water often froze in winter and it was difficult to free the outlet of ice. Then, again, if the outlet got choked with sticks or rubbish, it was very difficult to get at it to free it of obstructions, so that on the whole they were unsatisfactory. To obviate the difficulty of the old wooden covers, we introduced a few of the covers called "Concord grates." It was a pretty good grate in many ways, having an annular opening near the edge which created a whirling motion in the water, tending to keep it from clogging with leaves, rubbish, etc.

One great difficulty with all these basins is, not that they do not have capacity enough when running clear, but the great likelihood of clogging at the inlet. The problem is largely one of keeping this clear. This we have found the principal difficulty in Cambridge.

There was still another type of top, a square iron grate set in the old stone frame. This is an improvement on the wooden cover but it was found that it was liable to be thrown out of its seat by the passing of wheels or by a horse's foot, so that about

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* City Engineer, Cambridge, Mass.

1870 another type was introduced. In this type the inlet is in the curb, but the top opening and its cover is in the sidewalk, so the gutter is clear. That was a great improvement and much safer. These were large and expensive basins, the heavy granite top adding a good deal to the cost, which was about $150.00 each. In order to reduce the cost somewhat, another type was then tried, using the ordinary curbstone for the front, and making the top of North River flagging stone.

Now, after passing through these stages, in the 1880's, we adopted the type shown on Fig. 7, and it is practically the type we are using now. The body or pot is round, 5 ft. in diameter with the bottom 7 ft. 6 ins. below the curb. Instead of the granite bar stone, we use a modification of the "Boston trap," made of cast iron with a hood in front, which keeps the débris from passing into the outlet and making trouble, and it also gives it a water seal. It also has a metal valve opening outwards toward the sewer, so that, if the water in the basin gets low and below the hood, sewer gas will not come back into the air.

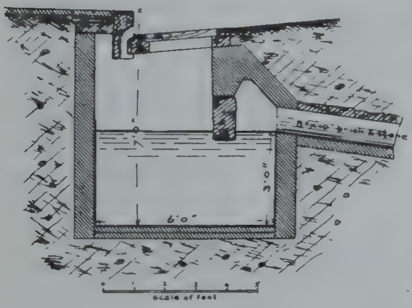

FIG. 6. OLD TYPE.

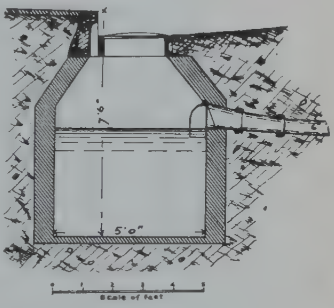

FIG. 7. PRESENT TYPE.

CAMBRIDGE, MASS.

We have tried various styles of hoods and traps, but have always come back to that, as about the best thing. The average cost of this type of basin has been about $75.00, including the outlet to the sewer. On the top or opening, we now use, instead of the wooden cover or square iron grate, what is called a D-frame and grate, placed in the gutter. It is made in the shape of the letter D, with a heavy iron frame and a perforated grate which is locked into the frame.

Behind the frame, a slot or throat is cut in the face of the edgestone, making two opportunities for the water to enter. This frame and grate weighs about 650 lbs. and costs about $12.50 per set. The iron trap costs about $5.00. The average cost of the stock, castings, brick, cement, trap, pipe, etc., is $40.00, and the cost of labor $35.00. The grate, frame and trap, with the hood thrown back, are shown in Fig. 8.

We find in Cambridge that one great difficulty with any grate is the liability to clog in time of storm. That is the reason for having the throat in the curbstone. But, even with that, it is not unusual for all openings to be completely sealed up with rubbish, with resulting flooding and damages.

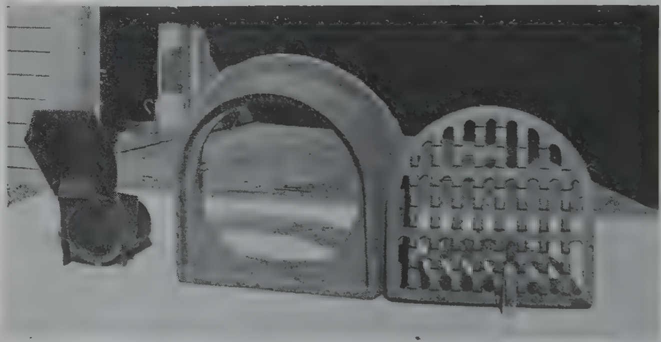

Fig. 8. Trap, D-Frame and Cover.

Recently I have tried the expedient, where the basin is located in an unfavorable situation, of placing at a short distance away from the regular basin, say ten feet, another grate with a connection to the regular basin, thus making a double inlet. This has worked very well. The outlets of our basins are made much smaller than is usual, I think. They were at first built of brick 8 ins. by 12 ins., then of 10-in. pipe, then 8-in. pipe, and now we are using 6-in. pipe. I have never heard of an outlet being stopped up yet on account of its small size.

We have about 2 260 basins in the city, and it is an expensive job to keep them clean. The excavation and transportation of the material are the important things. In Cambridge, the excavation has been done by hand labor by city men. It is very difficult to get any place to dump the material without making a long haul. It is now taken and dumped in some old clay pits in the western part of the city, making some of the hauls from two to three miles, which means, of course, a greatly increased cost.

In the "operating end" of this work we have carts with steel bodies and wooden running gear, and others entirely of wood. Two gangs, each consisting of four men and two horses, are employed. While one team is off to the dump with a load, the other is loading. A convenient rig, used for general handy work in attending the catch-basin and sewer-cleaning gang, consists of a small automobile with a light trailer attached. The little trailer carries about a half-ton load and is a very handy machine.

In Table 2 is shown an analysis of costs of the work done by the city in cleaning catch basins from 1905 to 1916, eleven years, and it is interesting as showing the progressive increase in the cost of cleaning. Column 6 shows the total amount expended for cleaning in the periods stated, the period 1908–9 being sixteen months. It will be noted that for the first nine years the yearly expenditure was about $6 000, while for the last two years it was $7 500. In Column 2, it will be noted that the number of basins cleaned decreased from 2 340 in 1906 to 1 128 in 1915–16. This brought the cost of cleaning per catch basin from $2.80 in 1905 to $6.48 (see Col. 7), and the cost per cubic yard from $1.55 to $3.00 (Col. 8). This is explained partly by the increase in wages of the men. In 1912, their pay was raised from $2.00 per day to $2.25, and in 1914, it was raised again to $2.50, with fewer hours of labor per week. I think, however, a larger factor is the constantly increasing length of haul to the dumps. This increases the cost of transportation and also tends to reduce the effectiveness of the men by making longer waits.

In 1915, a careful test was made to determine the cost of long hauls. The gang consisted of four men and two teams.

They cleaned out five basins in two half-days. The dump was two miles off. They took out 5.40 cu. yds. at a cost of $13.00. This made the cost, without any overhead charges, $2.40 per cu. yd., or $1.20 per yard-mile. We are looking for some practical means by which this cost can be reduced.

TABLE 2.

CITY OF CAMBRIDGE, SEWER DEPARTMENT, CATCH-BASIN CLEANING.

Date.	No. of C. B. Cleaned.	Quantity.			Cost.			
		Total Loads.	Loads per C. B.	Total C. Y.	Total.	Per C. B.	Per C. Y.	
1905	2 169	5 213	2.40	3 909	$6 089.69	$2.80	$1.55	
1906	2 340	5 609	2.82	4 206	6 060.54	2.58	1.44	
1907	1 948	4 704	2.40	3 528	5 070.78	2.60	1.44	
1908-9	2 742	5 906	2.15	4 429	8 090.67	2.95	1.82	16 months.
1909-10	1 874	4 157	2.22	3 118	6 732.10	3.32	2.16	
1910-1	1 672	4 181	2.50	3 135	6 225.35	3.72	1.98	
1911-2	1 466	3 676	2.51	2 775	6 344.19	4.33	2.30	Sept., 1911, pay raised to $2.25 per day.
1912-3	1 438	3 463	2.41	2 598	5 656.11	3.93	2.18	Total no. of C. B., 2 068.
1913-4	1 479	3 802	2.58	2 851	6 223.11	4.21	2.18	
1914-5	1 335	3 862	2.89	2 896	7 559.68	5.66	2.61	Oct., 1914, pay raised to $2.50 per day.
1915-6	1 128	3 247	2.88	2 436	7 309.71	6.48	3.00	Total no. of C. B., 2 129.

MR. EDGAR S. DORR.* — I have two or three designs of standard basins to show you and some figures of cost. Fig. 9 shows one of the standard basins in the city, similar to the one that Mr. Hastings has just shown, with a grate in the gutter, and a gutter mouth. This grate is now generally made square. I think we invented the D-grate, and have rather abandoned it now and substituted the square grates, principally for the reason that they are much easier to pave against. The principle is just the same. Our basins are also larger than any that have been shown, being 9 ft. deep. The big feature is the flap valve to be raised in order to let the water off when the basin is plugged and in order to facilitate cleaning. Our basins in Boston have been cleaned by contract for several years, and while we had the ordinary hood trap almost universally, which is hinged at the top and made to be pulled up in order to free the basin, we found a tremendous amount of leakage. If it were frozen or stuck a little bit, it was so much easier for the contractor to smash it than raise it that that was what he usually did. This design was made to overcome that. Where basins are cleaned by day labor, I don't think that difficulty would occur.

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* Office Engineer, Sewer Service, Dept. of Public Works, Boston, Mass.

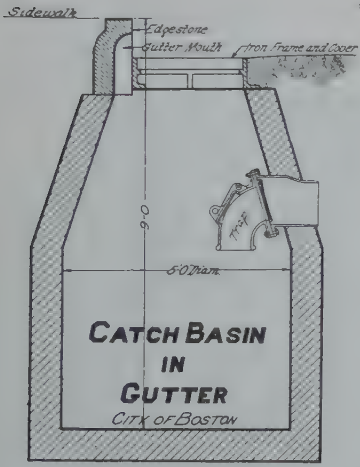

FIG. 9.

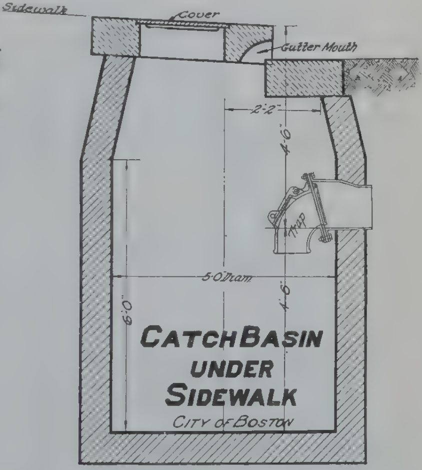

FIG. 10.

Fig. 10 illustrates a basin of about the same size located in the sidewalk. It is called in Boston the "Bradley" basin, with the heavy granite head, gutter mouth and gutter stone. It has the same general dimensions, 9 ft. depth and 5 ft. diameter, and is represented with the same trap. This trap is detachable, that is, the castings are furnished with flanges and are put together with bolts, so it is quite easy to take it off if it does get smashed. I think that is a good trap.

A basin which is a proposition of my own is shown in Fig. 11. It has never been built, and I put it in here to-night merely to start discussion. The great trouble in cleaning basins mechanically is the presence of sticks, wires, broken bicycles and that sort of thing which the people, especially in the poorer districts, appear to take delight in packing into the basins. This makes it almost impossible to clean them by mechanical means.

There is another abuse of basins probably not peculiar to Boston, and that is the piling into the basins of dry material from the streets by the street sweepers. That is sometimes carried on to a very large extent, and at other times not much. We have in many cases found basins which had been cleaned a short time before, filled with dry material, and no rain had occurred in the interval, so there was no question as to how it got there. Now, the idea is to take the gutter mouth from directly over the basin, put in the closed cover if it is in the gutter and a locked cover also, shift the gutter mouth a little to one side and make a kind of vestibule. In that way sticks could not be put in. Wires

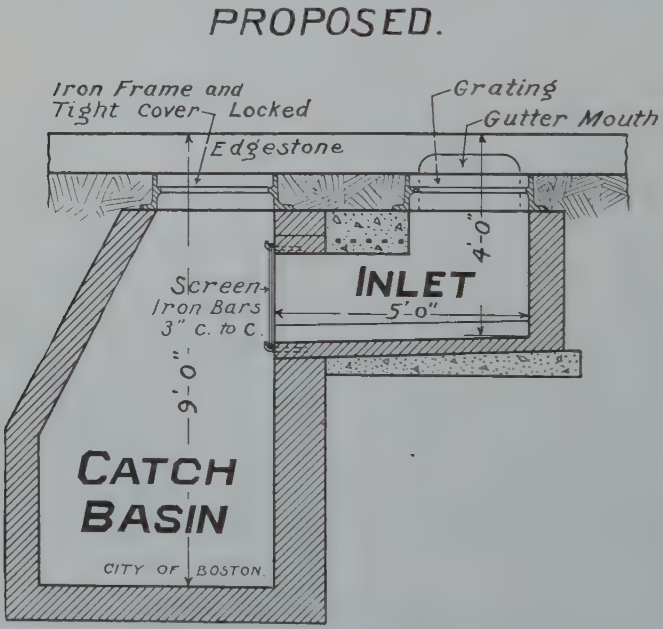

FIG. 11. BOSTON.

TABLE 3.

DATA ON CLEANING CATCH BASINS IN BOSTON, MASS.

Date.	Total Cu. Yds. Removed.	*Total Cost to City.	No. of Catch Basins Cleaned.	Average Yds. per Catch Basin.	Contractor's Price per Catch Basin.	Amount Paid for Inspection.	Average Cost to City per Catch Basin.	Amount Paid to Contractors.
1914–15	25 973.90	$38 147.91	7 775	3.34	$3.61	$7 789.26	$4.82	$30 280.12
1915–16	32 378.49	40 365.35	9 970	3.25	3.01	7 831.35	3.99	32 450.35
1916–17	In progress				2.29			

* *Note.* These figures include everything in connection with the cost of cleaning catch basins.

DUMPS.

South Boston, at McNary Park.	Average haul	= 1½ miles.
East Boston, at E. Bos. Land Co.	,, ,,	= 1½ ,,
Charlestown, at Everett Dump.	,, ,,	= 1 mile.
Brighton at Faneuil and private.	,, ,,	= 1 to 2 miles.
W. Roxbury, at Washington Street and at Nawn's Dump.	,, ,,	= 2 miles.
Dorchester, at Mills St. Dump.	,, ,,	= 1 mile.
Dorchester, at Codman St. Dump.	,, ,,	= 1½ miles.
South of Dover St., at McNary Park.	,, ,,	= 2 to 2½ miles.
North of Dover St., † Kemp Street.	,, ,,	= 2 to 3 miles.
Hyde Park, lot of dumps.	,, ,,	= ½ mile (?).

† *Note.* There is a private dump at the Fort Hill Dock, but the charge is exorbitant and the contractor will not pay it.

could be, but would be arrested by a coarse screen of round iron bars probably 3 ins. on centers. The street sweeper could pack in perhaps a bushel or two of material, and that would be all. The material that did get in the basin could be removed by some form of mechanical basin cleaner. How that would work out I don't know, but I think it would work well. The filling of this up with material from the streets would of course result in a plugged basin, and there would be many complaints in consequence, and it seems to me the result would be to prevent this practice. We have tried to find some form of mechanical cleaner but haven't met with any great amount of success. We tried a while ago, as Mr. Hastings did in Cambridge, a suction device called the Otterson.

The record of the costs of catch-basin cleaning in Boston for the last three years is given in Table 3.

There is only one more thing I can call your attention to, and that is the matter of the length of haul. Our length of haul runs from a mile and a mile and a half up to two and a half and three miles. That is a very serious matter. It seems to me that is bound to be the case everywhere. If you have a short haul it is soon used up and you are bound to have a long haul, and the conclusion to be derived from that is, in my opinion, that any form of mechanical catch-basin cleaner should be so designed that the expensive machine can be kept at work loading the material into other carts which can be kept running to the dump. The suction machine worked very well on basins filled with mushy material, but it wasn't economical for the reason that as soon as its load was up it had to go to the dump. More time was spent running to the dump and back than in cleaning the basin. This would be the case with all arrangements of that kind.

George H. Nye.*—As the catch basin is the connecting link between the streets and the drainage system, and its only function is to remove the water from the streets and deliver it to the sewers in a proper manner, no description of the basins would be complete without a consideration of the streets and the sewers.

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* City Engineer, New Bedford, Mass.

In the seventies, the streets in New Bedford consisted almost entirely of what are known as gravel roads, i. e., the natural loam with the sod removed, crowned up in the spring and down in the fall and winter. The main streets were paved with cobbles. There was, however, a very large amount of flagstone sidewalks with quarry faced edgestones, usually in short lengths. The gutters were cobble paved and deep, and extended across the intersecting streets, with cross-walks which were usually constructed of two lines of flat stone, each about 18 ins. wide, for the use of pedestrians. With this construction every vehicle crossing an intersecting street encountered two very pronounced "thank-you-marms" in its passage. There was also a deep gutter between the curb and the end of the crossing stone, which was been the cause of many bad falls.

These conditions were produced by what seems to have been a very strange catch-basin practice. At that time the catch basins were usually located at a considerable distance above the street corners, in some cases even near the top of steep hills where they were to take the water from cross streets, while the water collected on the steep hill was frequently carried for several blocks across intersecting streets.

A catch basin at that time consisted of a rectangular basin or receptacle, under the roadway, built of brick with stone sills and 2-in. plank set in a rabbet in the sills. A narrow neck extended for about a foot under the sidewalk, and a piece of flagstone set vertically under the curb served as a sort of trap. The opening in the curb was about 4 ft. wide and from 6 to 10 ins. deep, covered with a piece of flagstone which usually formed a part of the sidewalk. The basin was connected with the sewer by a pipe through the nearest wall. The basins held about three cubic yards of sand, and were cleaned through the opening in the street. This type of basin has now been almost entirely replaced by a modern one, as it broke into the street surface, the wooden cover was weak, and the basin occupied the location usually allotted to the underground conduits of the public-service corporations.

At that time the number of basins in a given distance was very much smaller than at present. I recall one case in which

1 500 ft. of gravel street was drained by a single basin. The nature of the street surface was such that the water from a heavy rainfall was much retarded in reaching the sewers. As our heavy rains seem always to occur in showers lasting perhaps five to seven minutes, this retarding of the run-off by its long route and the nature of the street surface reduced by a very material amount the maximum load which might have been put on the sewer system.

During the eighties, a movement for better streets resulted in the rapid building of macadam roadways, and this at once showed the desirability of eliminating the cross gutters at the street intersections. From this followed the policy of building catch basins at the low corner of each block, which is our general practice to-day.

At that time the basin was usually placed with its opening centered on the diagonal of the intersection. This was undesirable for several reasons. The opening was unduly prominent and unsightly, was in the line of travel, and the pitch of the basin in slippery weather made it somewhat of a danger. Worst of all, however, the currents of water in the gutters, flowing in opposite directions, met at the turn, and the centrifugal force at times of heavy rain caused more water to be thrown out over the crown of the street than entered the basin.

The basin of that period was constructed of brick with a flagstone and cement bottom, a 10-in. $\frac{1}{4}$-bend trap and outlet, and flagstone cover about 5 ins. thick and 5 ft. square. The basin was set partly under the walk, and the cover with its front edge cut to the radius of the corner, usually 8 ft., formed a part of the sidewalk. A circular hole, 2 ft. in diameter, was cut in the center of the stone and fitted with an iron cover giving access to the basin for purposes of cleaning and repairs.

With the advent of the basins placed at the low corners of the block, the cross gutters disappeared, but the stone cross-walk still held its place. As the streets gradually became better, however, the roughness of these crossings became more noticeable, and tar concrete, shaped to conform with the macadam, was substituted. These, of course, proved unsatisfactory as they were either too soft or so hard that the concrete crumbled in cold weather.

The present practice is to discontinue the use of cross-walks altogether, and this has proved very satisfactory.

The type of basin which we are at present using (shown in Fig. 12) is 6 ft. inside diameter and 6 ft. deep. The bottom is constructed of concrete in which, before it is set, the concrete blocks of the sides are bedded. The concrete blocks for the sides are 16 ins. by 8 ins. by 5 ins., and are manufactured in molds at the city yard. These sides are carried up to within three courses from the top, when specially beveled blocks 8 ins. by 5 ins. by 10 ins. to 11 ins. are used to reduce the size to receive the cover. The cover is constructed of concrete by our own force and is 5 ins. thick and 5 ft. square, made of concrete in the proportion of 1 part Portland cement, 1½ parts sand, 1½ parts pea stone, with the addition of about 2 qts. hydrated lime to each bag of cement, reinforced by expanded metal, and the upper front edge fitted with a corner bar. There is a circular hole in the center, 2 ft. in diameter, fitted with an iron cover for cleaning purposes. The concrete cover rests on the basin and on two 6-in. notches cut in the adjacent curb. The inlet is fitted with a concrete wash stone 6 ft. by 1½ ft. by 4 ins. set with

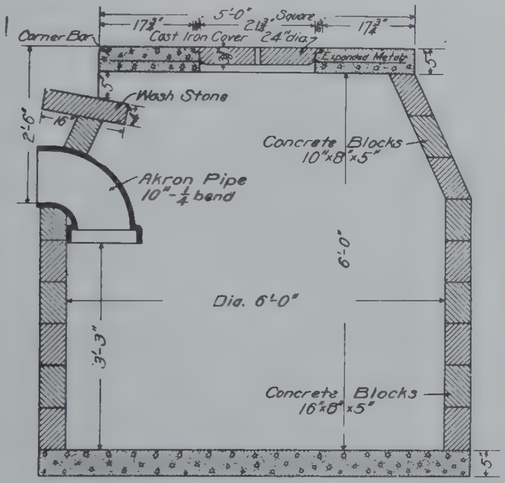

FIG. 12. NEW BEDFORD.

the gutter, and the trap and outlet consists of a quarter bend of 10-in. Akron pipe from vertical to horizontal. The basins are located with the end 6 ins. on to the end of the curved corner curb and extending in the direction of the straight curbing. The inside of the front edge of the basin is set 6 ins. in front of the straight curb, and the basin is usually placed to face on the street having the steepest grade in order to prevent a rush of water around the corner along the line of foot travel. In case the gutters on both streets have a heavy flow of water, the basin is placed facing on one of the streets and the same type cover or inlet is placed on the other street, with a funnel-shaped chamber slightly deeper than the gutter and ending in a pipe connected with the basin. This arrangement removes all the water from the line of travel and I think is the most satisfactory method of surface water removal that we have.

In the few cases where we have important crossings and no sewer, we have constructed an inlet as above described and connected it by a pipe with a similar structure on the low side of the crossing which discharges the water into the gutter on that side. In these cases we make no attempt to remove the street wash.

The cost of our catch basins averages about one hundred dollars. This includes the cost of drains as well as the excessive cost of some basins constructed in ledge. The cost varied during the last year from $30.55 to $145.93.

The basins are cleaned about twice a year, although certain areas require attention more frequently. The method of cleaning is by shoveling out the contents on to the street surface and removing it to dumps by teams.

The number of basins now in use is 1 526, and the cost of cleaning is about $2.50 each. The average haul is not less than one mile.

At the present time, with 187 miles of accepted streets, there are practically no cross gutters at street intersections on any of the improved streets. While this method of carrying the surface water has resulted in a very satisfactory condition of the streets, another phase of this subject has now been forced on our attention. With nearly all the streets laid with modern pavement or macadam coated with Tarvia, with more congested building, and with catch basins at every low corner, which are drained by a combined system of sewers, we are experiencing considerable trouble from the flooding of cellars during every heavy rainfall. The sewers, when built, were not designed for such a quick run-off, and are now found in many cases to be of insufficient capacity.

The solution of this problem for us will probably be the gradual construction of a separate system of sewers, utilizing the present sewers for either surface or sanitary sewage as circumstances may determine. If the buildings are disconnected from the present sewers these would in many cases be of sufficient size to care for the run-off, operating under a slight head. In extreme cases, even if the water were not removed from the street at once, no real harm would be done. A heavy downpour seldom lasts over five minutes, and the heaviest of which we have any record over a considerable period of years was at the rate of 6 ins. per hour for seven minutes, and occurred in July, 1915.

DAVID A. AMBROSE.* — Our standard catch basin differs to some extent from the city of Boston basin. The type which we have constructed for several years is shown in Fig. 13. The floor is of 2-in. spruce plank or of concrete. Plank is perfectly satisfactory and is easily laid where water is encountered during construction. The basin is 7 ft. 6 ins. in height from the floor to the casting, 4 ft. in diameter in the clear, and 4 ft. from the floor to the outlet. The trap is a casting having a lip embedded in the walls of the basin and a dome-like hinged cover. I believe it was originally called the Carberry trap. The walls of the basin are of brick or concrete. It has been specified at times that the contractor may have the choice of constructing either of brick or of concrete, and the choice has usually been to use brick.

Our standard frame and grate is 8 ins. in height, and the grate is 24 ins. in diameter, substituting the D type for the dished grate when the casting is installed against an edgestone.

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* First Asst. Engineer, Metropolitan Park Comm., Boston.

An opening is cut where the D-frame comes in contact with the edgestone. We use more of the former type, as most of our parkways are designed with a planting space between the roadway and sidewalk, so that edgestones are not necessary except at street intersections. Along roads with level grades, catch basins are installed about 200 ft. apart, the gutter being crowned 4 or 5 ins. half way between basins. The weight of castings, including both frame and grate, is about 500 lbs. The cost of the basin, not including excavation, has been by contract from $50.00 to $55.00.

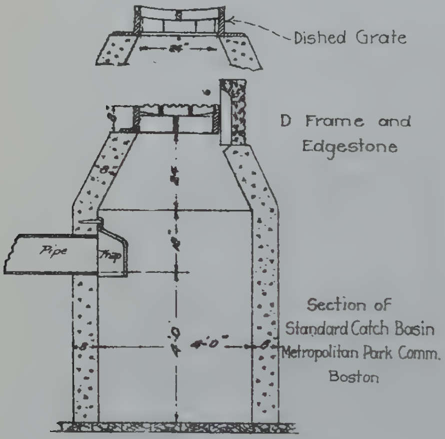

FIG. 13. MET. PARK COMM.

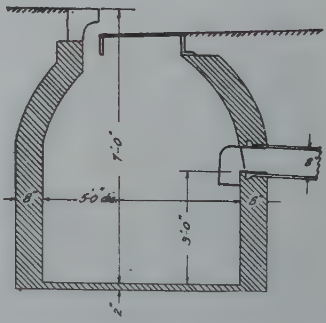

FIG. 15. FITCHBURG, MASS.

PHILIP W. TAYLOR. — The subject of catch-basin cleaning is one on which more and more study must be made. The conditions of labor, streets and dumping places offer new fields for study as time goes by. At the present price of labor and the increased demand for labor at far pleasanter occupations than cleaning catch basins, it is a question how much longer cities will be able to maintain efficiently their catch basins. The item of maintenance is increasing rapidly in most cities, and when the figures for this year are published there will be noted a marked increase in many cases provided the basins have been as thoroughly cleaned as in other years.

A very serious problem is the question of dumping. Very few cities have made any provision for dumping places, and consequently a large proportion of the cost of cleaning basins is due to long hauls. It seems to me that it is imperative that city officials should call the attention of the city governments to the need of providing proper dumping places. It is not necessary that the lots used for dumping be bought outright, but they may be leased for a period of years.

I desire to present to the Society to-night a few views showing the Otterson Auto Eductor for cleaning catch basins. This machine is the invention of Mr. George W. Otterson, of Seattle, Wash., and has been used successfully in the West, and seems to be cleaning the basins very easily and economically.

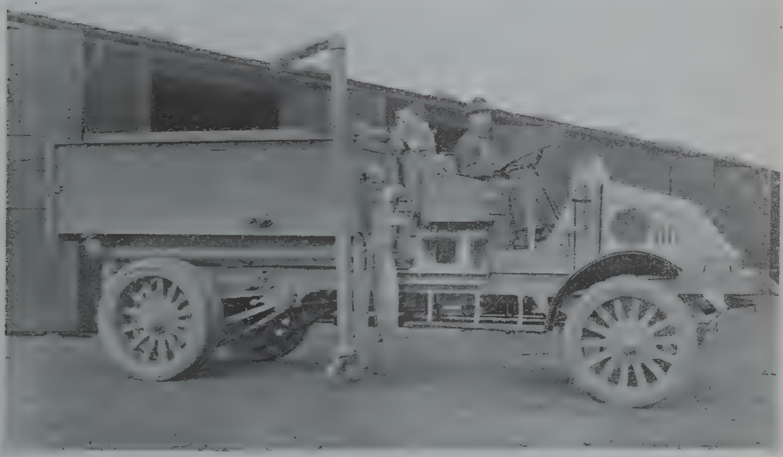

FIG. 14.

The Auto Eductor (Fig. 14) consists of a centrifugal pump, sand eductor, dump body and necessary pipes and fittings, all mounted on a Kelly Springfield motor truck. The centrifugal pump is driven from the main engine shaft by a silent chain. The dump body is a steel box about 9 ft. long, 6 ft. wide and 3 ft. deep. It is divided into two chambers, one for the settling of the solids and the other to serve as a supply chamber for the pump. The settling chamber is subdivided by vertical steel baffle plates which are the same depth as the dump body and about a foot less in width. These are staggered so that the water and pumped material must flow from side to side as it advances to the back of the machine. These baffles are hung on horizontal pipes at the top of the body and are free to swing so that when the load is being dumped and the body is in an inclined position the material may slide under them. At the back of the settling chamber there is a steel plate screen through which the water passes into the supply chamber.

The eductor is a patented device and consists of an orifice and throat as in the sand ejectors. This is made up of manganese steel on account of the severe wear to which it is subjected. The mouthpiece is made so as to be easily removed and renewed if necessary.

The operation of cleaning a basin is as follows: The truck is first driven to a hydrant and about 400 gals. of water taken on. The truck is then driven to the catch basin, the cover lifted and the pipe and eductor on the side is let down into the basin. The piping is so arranged that any basin located within six feet of the curb line may be cleaned. The suction valve in the supply chamber is then opened, allowing the water to flow into the pump by gravity. The pump is then thrown in by levers at the driver's seat, and the water flows through the hose down into the return bend in the basin, then up through the eductor into the settling chamber. A supply of water is taken from the pump discharge pipe into a small hose which terminates in a piece of ordinary wrought-iron pipe on the end of which there is a reducer which serves as a nozzle. By manipulating this pipe, which we may call an agitator, it is possible to soften the material and cause it to sluice toward the eductor inlet.

The material is sucked into the eductor and lifted into the settling chamber. It then flows from side to side, passing the baffles at alternate ends, and deposits the heavy material. It then flows through the screen into the supply chamber, thence to the pump and is ready for another cycle. In this way it is possible to use the original supply of water over and over until it is displaced by the heavy cleanings. After the basin is cleaned the supply of water is shut off, the pump is stopped and the pipe lifted out of the basin by means of a crank and pulley on the side of the body.

After the settling chamber is full, which may be from two or more basins, the truck is driven to the dump and dumped by means of the hydraulic dump device which is driven by the engine.

The work may be done by an operator and one helper, but probably more efficiently with two helpers. It is unnecessary for any one to get into the basin. Material that is too large to pass through the eductor may be taken out with hook rakes from on top.

One very important feature of the machine is the possibility of cleaning the basins without making any litter on the street or creating a nuisance.

It is very necessary to the successful operation of this machine that the dump be controlled by the city. Owing to the weight of the truck when loaded (about nine tons) and the liquid condition of the material, it would probably be necessary to lay planks on the surface of the dumps.

In order to show the possibilities of this machine, I find in a report made to the Commissioner of Public Utilities of the City of Portland, Ore., that in a test of four and one-half hours' duration 84 basins were cleaned at an average cost of about nine cents per basin. In an actual day's work of eight hours the machine cleaned 137 basins. An interesting feature of the test above is that the total amount of material actually removed from the 84 basins was only 13 cu. yds., so that the cost averaged about sixty cents per yard, but it must be remembered that a large share of the time was spent in going from basin to basin and lowering the machine, so that the cost per cubic yard is high. In connection with this data it should be stated that in the West the large curb openings are absent and all of the water passes through the grate openings, therefore the material is much easier to handle than in the East, where almost anything in size up to a football may be found. It would seem as if it would be possible in the West to keep the basins in a much better sanitary condition than is possible in the East, for they may be cleaned several times a year and not allowed to get dry, as often occurs in this part of the country.

Another use to which the eductor as described above can be put is a permanent installation in a grit chamber or large catch basin. By proper connections with city water mains, it is possible to clean these chambers simply by operating a valve and making the water lift the material to the truck. In Seattle several of these eductors are being used in specially designed grit chambers, and in one case the material is lifted over sixty feet in height by the water.

Gordon H. Fernald.* — Fitchburg has about 1 000 catch basins of various sizes and shapes, but during the last four years we have adopted as standard, one which is 5 ft. in diameter and 7 ft. deep below the top of the curb (Fig. 15). The outlet or lead, usually 8-in. tile pipe, is three feet above the bottom of the basin, which gives a storage capacity of about 2¼ cu. yds. Unless the lead goes into a strictly storm sewer we use a cast-iron trap consisting of a flap valve to prevent odors coming from the sewer and a hood to prevent sticks or other obstructions from getting under the flap valve and holding it open.

These catch basins have a 2-in. brick bottom laid in dry cement and sand, with 8-in. brick walls, the top half of the walls being plastered on the outside to prevent frost action on the brick work.

The center of the basin is one foot out from the curb line and the basin is covered with a cast-iron frame and grate set in the gutter in addition to the gulley inlet. This grate is 24 ins. square and together with the frame weighs about 600 lbs.

Relative to the grate itself we have three different types· a solid cover, which we are gradually doing away with; a plain slotted grate, and a ribbed or rough surface grate which has been developed during the past two years and is very satisfactory.

On account of our many hills (some of which are very steep) it is necessary to bank our grates or else build a dam on the lower side in order to conduct the water into the basin. This is not an ideal way, therefore the ribbed or rough surface grate was designed. This grate has the bars running diagonally with the sides or gutter and the back edge of each bar $\frac{1}{4}$ in. lower than the front edge of the grate. This arrangement makes a sawtooth surface that slows down the velocity of the water reaching it and diverts it partially towards the gulley opening and partially down through the grate.

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* Asst. Engineer, Sewage Disposal Comm., Fitchburg, Mass.

This grate clogs with papers, leaves, sticks, etc., as do all other grates, but even though clogged in most cases still diverts the water towards the gulley opening.

The cost of constructing a standard catch basin in 1913 was $75.97, this being an average of 20 basins built that year, and divided as follows:

Labor,	40%,	Mason and foreman, 34 cents. Common labor, 25 cents.
Castings,	19%,	$1.85 per 100 lbs.
Brick,	15%,	$9.50 per 1 000 delivered.
Cement,	8%,	$1.74 bbl.
Miscel. material,	8%,	Gulley stones: straight, $5.00 each; curved, $6.00 each. Traps, $5.00 each.
Overhead,	7%.	
Pipe leads,	3%.	

We spend annually between $3 000 and $4 000 in cleaning catch basins, making three complete rounds of the city and cleaning certain basins more often as needed. Some basins need not be cleaned more than once in two years, while others need attention five to eight times each year, depending on the rains.

On a complete round, our cleaning is carried on by one foreman, seven laborers and three double teams. The foreman determines which basins are to be cleaned and keeps the cost record of the work. Six of the laborers work in pairs, taking daily turns in going into the basins. The other laborer acts as loader together with the teamsters.

On reaching a basin to be cleaned, the top man bails out the water if any (a basin is not cleaned if it has 18 ins. of water in it) and then with a post-hole spoon takes out enough material so the bottom man can enter. The bottom man shovels the material out of the basin and the top man piles it in the street for the teams to pick up.

FITCHBURG SEWER DEPARTMENT.

MAINTENANCE.

FOREMAN. ______________ DATE. ______________ 19____

Catch Basin.	Loads.	Labor.				Dump.
		Time.	Bottom.	Top.	Team and Loader.	

FIG. 16. TIME SHEET.

A time sheet (Fig. 16) made up to analyze the cost of catch-basin cleaning was developed in 1915 which shows some interesting cost figures. In the column "Catch Basin" is entered the location of the basin cleaned, in the "Loads" column the number of loads, time taken in cleaning in the "Time" column. The number of the bottom man goes in the column "Bottom," as does the number of the top man in the column "Top." The number of the team and loader are entered in their column, and the location of the dump under "Dump."

The distance of the basin from the dump is scaled from a map of the city to determine the length of haul.

The short haul shown in accompanying table for 1915 is probably accounted for by a severe storm on August 4, which caused several washouts, allowing us to take advantage of very short hauls by filling these holes.

The teams, being timed carefully during May and June, showed them to be on the road 45 per cent. of the total time. This apparently shows that some faster mode of transportation would reduce the cost of this item in the future, especially as,

TABLE 4.

COST OF CLEANING CATCH BASINS, FITCHBURG, MASS., 1915.

Month.	Catch Basins Cleaned.	Cu. Yds. Cleaned.	Av. Cu. Yds. per C. B.	Cost.			Total Haul One Way. Ft.	Av. Haul per Cu. Yd. One Way. Ft.	Av. Costs per Cu. Yd.			Total Av. Cost per Cu. Yd.
				Exc.	Load.	Team.			Exc.	Load.	Team.	
March	20	43	2.15	$33.34	*	$32.14	31 250	725	0.775	....	0.747	$1.52
April	133	318	2.39	168.06	$35.87	187.05	575 125	1 809	0.528	0.113	0.588	1.23
May	205	462	2.25	236.56	57.84	264.12	670 800	1 452	0.512	0.125	0.572	1.21
June	15	25	1.67	17.07	*	19.05	74 800	2 992	0.683	....	0.762	1.45
July	331	618	1.87	305.00	58.84	295.58	958 075	1 550	0.493	0.095	0.478	1.07
Aug.	290	715	2.47	326.80	59.35	357.89	961 400	1 345	0.457	0.083	0.500	1.04
Sept.	222	588	2.65	261.61	48.83	195.04	832 900	1 417	0.445	0.082	0.332	0.86
Oct.	32	59	1.84	24.13	*	26.50	43 150	731	0.409	....	0.449	0.86
Nov.	31	46	1.48	22.68	*	24.80	120 000	2 609	0.493	....	0.539	1.03
Totals and av.	1 279	2 874	2.25	$1 395.25	$260.73	$1 402.17	4 267 500	1 485	0.485	0.090	0.488	$1.06

Foreman's time divided proportionally into cost of exc., load and team.

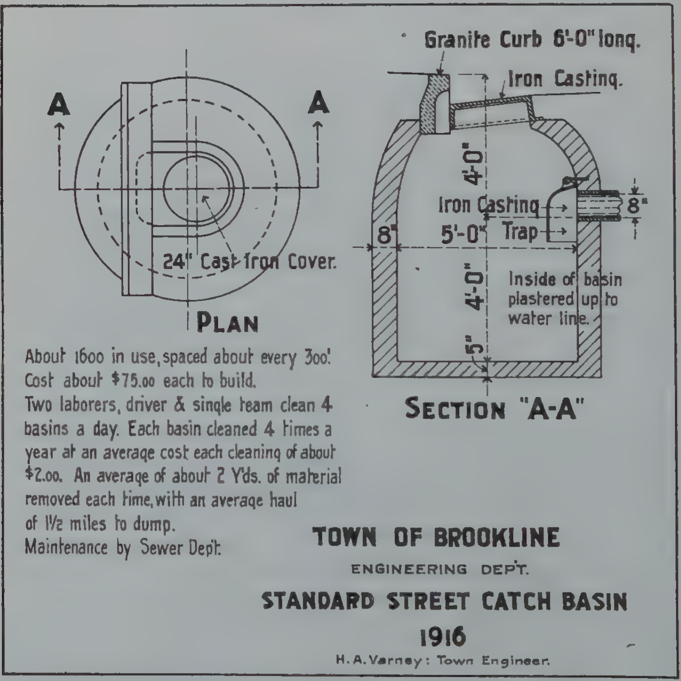
* No regular loader, foreman and teamster loading.
Aver. cost shows exc. 45.6%, load 8.5%, team 45.9%.
Movement of teams for May and June shows them on the road 45% of time.
Labor, 28 cents per hour; teams, 62½ cents per hour.

owing to the normal growth of the city, longer hauls will be required to reach available dumps.

A " load " is a single load of catch-basin material. This is very indefinite, as they vary considerably, depending on the amount of water, or tin cans and rubbish, as well as the nature of haul, whether uphill, downhill, good roads or bad. An average of many measurements taken at various times shows in our case that a load is a cubic yard.

We feel that in addition to the detailed information gained by this method of cost keeping, the men and drivers are more careful to keep busy, knowing that their work is kept track of.

Henry A. Varney.* — The standard basin used in Brookline is the same type as that used in Cambridge. About thirty



About 1600 in use, spaced about every 300'.
Cost about $75.00 each to build.
Two laborers, driver & single team clean 4 basins a day. Each basin cleaned 4 times a year at an average cost each cleaning of about $2.00. An average of about 2 Yds. of material removed each time, with an average haul of 1½ miles to dump.
Maintenance by Sewer Dept.

TOWN OF BROOKLINE
ENGINEERING DEPT.
STANDARD STREET CATCH BASIN
1916
H. A. Varney: Town Engineer.

FIG. 17.

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* Town Engineer, Brookline, Mass.

years ago the basins were built with a big granite top. The objection to this was that the opening came in the sidewalk and the cleaning was disagreeable for passersby. The present type of basin seems to be very satisfactory. In some cases we use a grating instead of a solid cover. The data given in Fig. 17 show all the obtainable information. I would say that we have used the double inlets to a certain extent in Brookline, but we usually put a basin at each end of the curb. It is rather expensive but it seems to be the best way.

Mr. Wm. A. Brown.* — In any community where a sewerage system is installed, there existed primarily the dual necessity of disposal of wastes and of surface or rain water. A sewerage system representing a big outlay must for utility and also for economy of maintenance be protected, and for this reason ordinances are usually enacted for the regulation of waste disposal, and catch basins are constructed for the reception of surface water.

A direct run into the sewer proper for surface water is always objectionable, for the very evident reason that material of various kinds, such as is always present in greater or lesser degree in the gutter, will be washed into the sewer, making a condition which will eventually result in the clogging of the system.

This is avoided by the construction of catch basins provided with a chamber for the sediment and supplied with a trap which prevents the access of rubbish to the sewer.

Fig. 18 illustrates the type of basin constructed in Providence. This basin is provided with a frame and cover designed in the city engineer's department, the cover being reinforced with ribs giving a light but serviceable construction and known as the " Providence Pattern."

At this date, there are in Providence about 5 700 catch basins and over 2 000 extra inlets.

One type of extra inlet, suitable for low points in the pavement, consists of a rectangular grating which is provided with a small sand catcher. These are used in car tracks and elsewhere and are satisfactory, being supplied with an 8-in. pipe running to the nearest basin.

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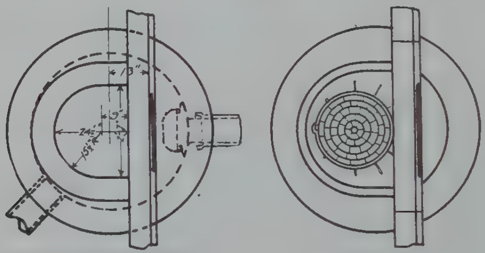
* Assistant Engineer, Highway Dept., Providence, R. I.

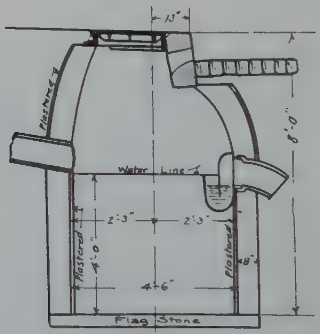
In some cases a "spider basin" is built, consisting of a catch basin in the street with extra inlets connecting therewith in several directions. This type of basin is considered generally unsatisfactory for obvious reasons.

The cleaning of the catch basins in Providence is done entirely by hand, a process which is satisfactory in its efficiency and also economical. On account of physical difficulties due to the fact that the so-called "East-Side" of Providence is built on a steep hill, the cleaning of basins in this section is more expensive, as a full load of material removed cannot be carried. As the cost of this work is kept in connection with other department work, it is not practicable to give a comprehensive statement of the cost, but it has been estimated that for day



Plan without Manhole Frame

Top



Section

FIG. 18. STANDARD CATCH-BASIN, PROVIDENCE, R. I.

work it costs $1.15 per cu. yd. and for night work $1.58 per cu. yd. for removal of material from basin, and this is estimated for an average haul of one and one-half miles.

Table 5, taken from the report of the "Department of Public Works" of Providence, 1915, page 33, shows the work performed by the Sewer Maintenance Department, cleaning basins for the fiscal year ending September 30.

TABLE 5.

WORK PERFORMED BY SEWER MAINTENANCE DEPT. OF PROVIDENCE, R. I. CLEANING CATCH BASINS FOR YEAR ENDING SEPTEMBER 30, 1915.

Month.	Number of Times Catch Basins Examined.	Number of Basins Cleaned.	Deposit Removed. Cu. Yds.
Oct., 1914	Once	1 106	1 669.10
Nov.	"	672	806.63
Dec.	"	175	247.92
Jan., 1915	"	159	341.78
Feb.	"	431	987.00
Mar.	"	1 275	2 217.21
Apr.	"	829	911.03
May	"	978	1 440.87
June	"	1 020	1 665.48
July	"	744	957.85
Aug.	"	715	1 825.00
Sept.	Twice	1 019	1 525.00
Total	13	9 123	14 594.87

1.6 cu. yds. deposit per basin cleaned.

The matter of the location of basins in streets is important, and I recommend it for serious attention. In my own observation, in many cities the location of basins seems to be at fault. Frequently the basins are so located as to bring the surface water during precipitation directly in the path of pedestrians, causing no little annoyance. A proper coöperation between the sewer engineers and the highway engineers would have remedied this fault, for the basins would have then been located with regard to this important feature of keeping the crossings dry.

This present season in this city witnessed an interesting change in the locations of several basins which had done excellent service for decades in their old locations but which, owing to structural changes in a certain important street, were rendered practically worthless.

This was brought about by the rebuilding of Benefit Street with a permanent smooth pavement on a concrete base, to supersede the old macadam and cobble-gutter type of construction. Benefit Street being on a side hill and having steep cross streets presented a problem in changing from a macadam to a smooth pavement, especially at the intersecting streets on the low side. In several cases it was found possible to pave the street only by turning the surface water across the whole width of the roadway, and by so doing the basins on the high side had to be discarded and extra provision for the added flow of water made on the low side.

I wish to acknowledge assistance in preparing this brief discussion from Mr. John E. Bowen, assistant engineer, City Engineering Department, and from Mr. Colver L. Saunders, superintendent of Sewer Maintenance Department, of Providence.

MR. EDWIN H. ROGERS.* — The city of Newton, Mass., comprises an area of 18 square miles, has 145 miles of accepted streets and 79 miles of private ways. To January 1, 1916, its surface drainage system consisted of 60 miles of stone, brick and concrete conduits and vitrified pipe drains, with 2 637 catch basins, or an average of one catch basin for each 120 lin. ft. of drain.

In constructing new streets for acceptance or when installing a drainage system in old streets, it is customary to place catch basins on each side at a maximum distance of 300 ft. apart on continuous grades, at such other points as changes in grade may require, and near each tangent point of the curves forming the street corners.

For a number of years past, the catch basins have been built mostly of brick, circular in section, with an inside diameter of about 4 ft., and about 6 ft. in depth. The brick side walls are laid in cement mortar, are 4 ins. in thickness for the cylindrical portion, which is from 3 ft. to 4 ft. in height, and the arch supporting the gratings is 8 ins. in thickness. The bottom of the basins is paved with brick laid flat, without cement, 2 ins. in thickness, the joints being filled with dry sand. The basins are not provided with traps, and the outlets are usually 8-in. pipes leading directly to the drains.

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* City Engineer, Newton, Mass.

The topography of the city is such that a majority of the drains have sufficient pitch to keep themselves clean of such materials as may wash into them from the basins. The outlets are usually placed so as to provide from 1½ ft. to 2 ft. of cover over the outlet pipe whenever the grade of the drain to which they are connected will permit.

The covers on a large majority of the basins are Concord gratings with a convex top. This type of grating is inexpensive and has proved fairly satisfactory on our residential streets, but these gratings are now considered unsuitable on thoroughfares having a traffic of other than light vehicles.

Special apparatus is not used for cleaning the catch basins, the street washings being removed from the basins by the use of spoon shovels, deposited on the surface of the street, and then loaded into carts and carried away to the most convenient dump. The work is done by the street department by day labor, the average amount removed per basin per year being 1.9 cu. yds., at a cost in 1915 of $1.90 per basin, or $1.00 per cu. yd. Dumps are numerous, and the length of haul seldom exceeds one mile. The basins are not cleaned at regular or specified times. They are all thoroughly cleaned in the fall of the year and at such other times as may be necessary.

Complaints of catch basins as a source of mosquitoes are infrequent, and the reason for this is attributed to the use of oil on the majority of the streets, which tends to wash into the basins and prevent the breeding of these pests.

MR. W. L. VENNARD.* — The standard catch basin of the city of Lynn (Fig. 19) is built primarily to catch gravel and other sediment carried by storm water in the gutters. Most of the basins of Lynn empty into the combined sewerage system. Some are drained into culverts carrying brook waters. They work efficiently when built to the standard pattern and are useful to keep gravel from entering our sewers.

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* City Engineer, Lynn, Mass.

The basins are cleaned by hand, which is to say, a man goes into the basin, shovels the gravel into buckets and it is raised by hand and dumped into a cart which hauls it to a dump. The opening for cleaning the modern basin is through the throat of the D-grate in the gutter, there being no opening in the sidewalk. It will be noted that the openings in the D-grate are

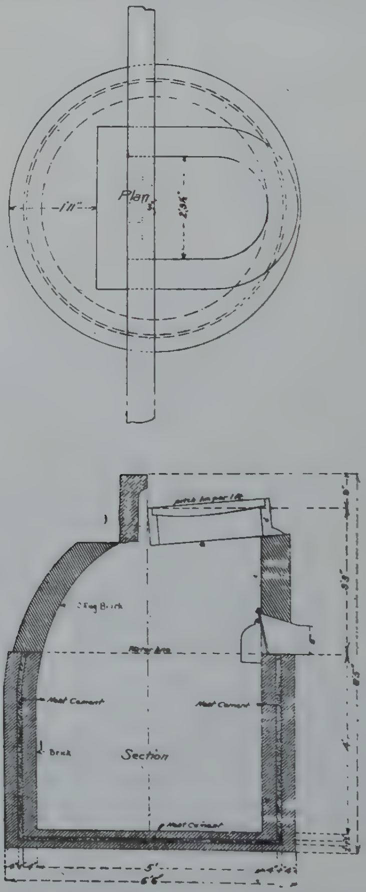

FIG. 19. LYNN PATTERN.

supplemented by a throat cut in the curbstone, and I wish to remark that the basins, as sometimes built without throats, do not take the water efficiently. The grate, at the beginning of a rainstorm, becomes covered with leaves and paper or other débris and the water passes over, while those that have the throat permit the water to enter through it and the swirl of water entering generally tends to keep the grate clearer from débris than when there is no throat.

The cost of cleaning basins in 1915 was as follows:

Labor	$3 619.86
Teams	663.34

This, together with the cost of salt and a few incidentals, brings the total to $4 359.85. The single teams are hired from the highway department by the drainage department, $0.17 per hour being charged for same and $0.36 for double teams per hour.

Total number of basins cleaned in 1915	1 442
Average cost of basin cleaned in 1915	$3.02

The basins are built 8 ft. deep and have a trap at the outlet 4 ft. above the bottom, which causes a water seal in tight basins, preventing odors from arising from the sewer.

The length of haul is estimated to be one mile.

Other costs of cleaning are given below, in Table 6.

TABLE 6.

COST OF CLEANING CATCH BASINS IN LYNN, MASS.

Year.	Number of Catch Basins Cleaned.	Total Cost of Cleaning Basins.	Average Cost of Cleaning per Basin.
1899	1 138	$2 537.74	$2.23
1900	731	1 834.81	2.51
1901	1 110	2 286.60	2.06
1902	671	1 570.14	2.34
1903	835	1 928.85	2.31
1904	891	1 844.37	2.07
1905	956	1 921.56	2.01
1906	1 047	2 355.75	2.25
1907	1 004	2 148.56	2.14
1908	1 153	2 279.54	1.97
1909	988	1 729.71	1.75
1910	....	......	....
1911	....	2 831.00	....
1912	1 417	2 806.03	1.98
1913	1 742	3 715.20	2.13
1914	....	......	....
1915	1 442	4 359.85	3.02

MR. FRED R. CHARNOCK.* — It is our custom to build catch basins for the reason that the gradient of a great many of our surface drains is so flat that it is necessary to retain as much sediment in the catch basins as possible. If we had grades sufficiently steep to keep the pipes clear, I should probably omit sand catchers in many locations.

Catch basins are cleaned by manual labor. We have no special apparatus for this purpose, for, the bottom of the basins being only six to seven feet below the surface, we have no particular trouble in keeping the basins clean in this manner.

The cost of cleaning at the present time is about 75 cents per cu. yd.

The average haul of the dumps is about one-half mile.

In the year 1913, which is the latest time on which I have the data available, there was 1 058 cu. yds. removed from the basins, and the cost was $738.69 for labor and teaming.

MR. WALTER E. NOBLE.† — The standard catch basin used in Fall River is shown in Fig. 20. A few catch basins in connection with special work have been built of concrete and a few of the brick ones have had reinforced concrete cover stones, but granite in large blocks is plentiful here, and that continues in general use.

We have practically no direct openings from the gutter to the sewer, and, while I recognize the force of some of the arguments advanced in favor of such openings under some conditions, I should be reluctant to recommend their adoption here under the existing conditions.

There are a good many steep streets in Fall River, some with slopes of 15 per cent., and every heavy rain washed down to the basins a large amount of dirt and, even with them, a considerable quantity collects in the outfall sewers and about their outlets.

Catch basins are cleaned generally by three men, one in the basin filling pails and the others on the surface hoisting out by hand rope and dumping. The material is removed in carts with metal bodies to the most convenient place of disposal, which is generally a house lot below grade.

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* City Engineer, Medford, Mass.

† Assistant City Engineer, Fall River, Mass.

The annual report of the Street Department for the year 1915 states that there were 3 091 cleanings of catch basins, which would be an average of 2.87 times for each of the entire number in use, although actually some basins were cleaned a great many more times and some not more than once, if at all. The average cost for each cleaning is given as $4.09.

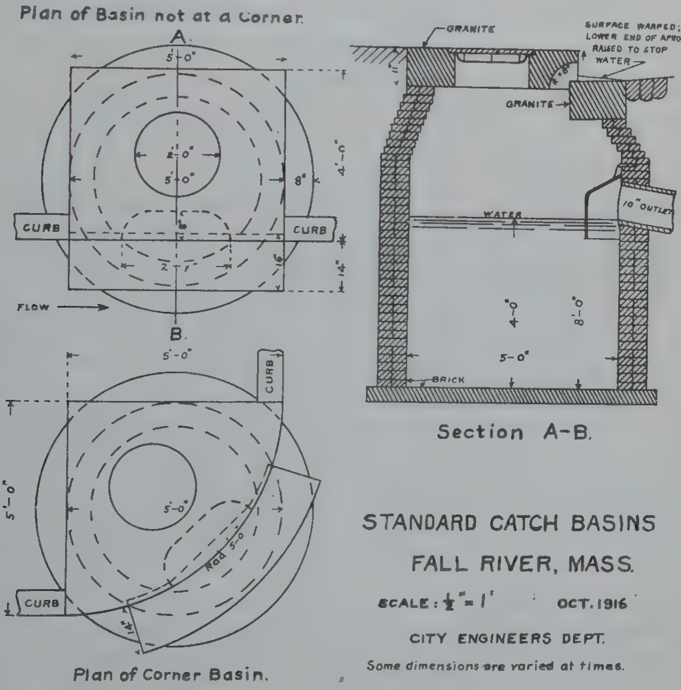

FIG. 20. FALL RIVER, MASS.

MR. JOHN H. GREGORY.* — I wish to call attention to an article on "Hydraulic Ejectors for Grit Removal Merit Trial in Sewer Maintenance," published in the *Engineering Record* of January 29, 1916. If I were to prepare a discussion I could not express my views better than in this article. The two photographs shown in the article are, so far as I know, the only ones in this country of the Frankfort wagon used for cleaning catch basins.

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* Of Hering & Gregory, Consulting Engineers, New York.

Mr. Frank A. Marston.* — Catch basins have been in use for many years, and for some time were considered a most necessary part of a sewerage system receiving storm water. Street detritus was washed into the sewers in times of storms and collected in sections where the velocity was low, forming deposits which were expensive to remove. The practice of building catch basins to intercept this material is still followed in many of the older American cities, and in some places this practice has become a matter of custom rather than a need.

Many of these basins are constructed with traps or water seals to prevent air from the sewers being discharged through the inlets into the streets. There appears to be some question as to whether this practice is justified. The value of catch basins or inlets which are untrapped, as a means for ventilation of the sewer, has been recognized for many years.

In the report of Samuel M. Gray on the proposed plan for a sewerage system in the city of Providence, presented in 1884, is the statement:

> " As the inlets to the catch basins are likely to be kept free from snow, such of them as can be left untrapped without causing offense may be left in that condition to serve for ventilation when the openings in the center of the street are covered with snow."

There is a growing tendency to omit traps from inlets, as shown by the latest designs prepared by the cities of St. Louis, Pittsburgh and others.

Several investigators have pointed out that catch basins may become breeding places for mosquitoes unless means are taken to prevent. This difficulty is removed where inlets of proper type can be constructed in place of structures holding water.

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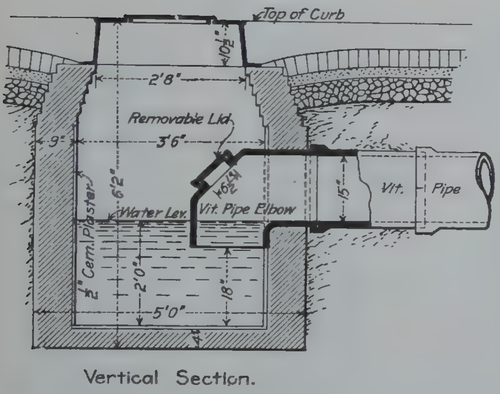
* Designing Engineer, Metcalf & Eddy, Consulting Engineers, Boston.

Catch basins have been constructed to suit particular needs and the ideas of various designers. A number of typical designs which have been adopted as standards for various cities are shown in the accompanying figures.

Fig. 21 shows the standard catch basin used for many years in the city of Columbus, Ohio. The interior diameter of the basin is about 3 ft. 6 ins., and the depth of water below the invert of the trap is 2 ft. There is one chief objection to this design; that is, the danger of breaking the trap, which is of vitrified clay, either while the work of cleaning the basin is in progress or by freezing in the winter. This objection could be partially obviated by the substitution of a cast-iron elbow in place of the vitrified pipe elbow.



Vertical Section.

FIG. 21. COLUMBUS, OHIO.

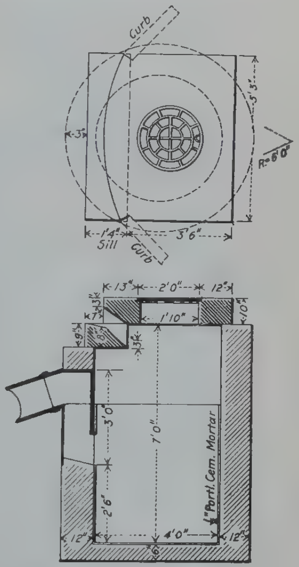


FIG. 22. NEWARK, N. J.

The standard catch basin used at Newark, N. J., is shown in Fig. 22. This is of a different type, in which the trap is constructed as a part of the wall of the basin. The interior of the basin is 4 ft. in diameter, and the depth of water below the invert of the outlet pipe is about 4 ft. In this form there is no grating, all the water entering through the opening in the side of the curb.

Fig. 23 shows the type of catch basin used as a standard design in the borough of the Bronx, New York. This basin is constructed of reinforced concrete or brick masonry about 3 ft. 6 ins. by 4 ft. 11 ins. in plan, with a depth of water below the invert of the outlet pipe of 3 ft. 4 ins. The water enters the basin through an opening in the side of the curb. Six standard modifications of this design have been provided for varying conditions and the use of other materials. Fig. 24 shows the type adopted for the circular brick catch basin, in which the water enters through an opening in the side of the curb as well as through a grating in the gutter.

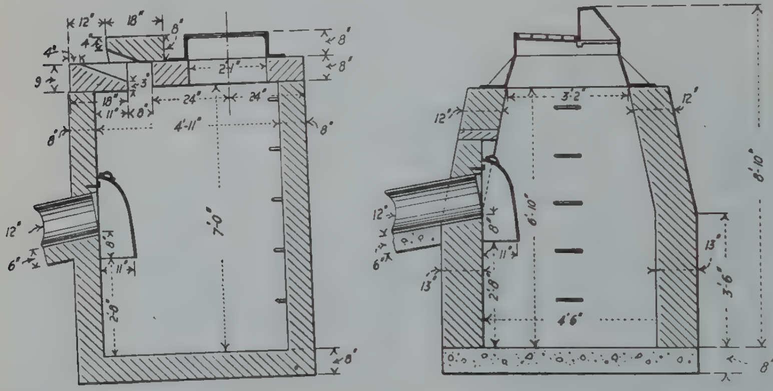


FIG. 23. FIG. 24.

BOROUGH OF THE BRONX, NEW YORK.

The standard catch basin adopted by the borough of Manhattan, New York City, is of a similar design as shown in Fig. 25, this particular basin being intended for use on the corner at a street intersection. The interior of the basin is 4 ft. in diameter.

The standard catch basin adopted in Pittsburgh, Pa. (Fig. 26), is one of several published by the Department of Public Works of Pittsburgh in 1911. (See also *Eng. & Cont.*, July 17, 1912, p. 73.) The interior of the basin is rectangular in plan, 4 ft. 6 ins. by 3 ft. 6 ins., and the depth of water below the invert of the outlet pipe is 20 ins. The water enters this basin through an opening in the side of the curb, there being no grating in the gutter.

The standard catch basin in the city of Boston, described by Mr. Dorr, has proven satisfactory in most respects and has been adopted for use in a number of other cities and towns. Both the form of trap and grating are noteworthy features and have many points to recommend them for use.

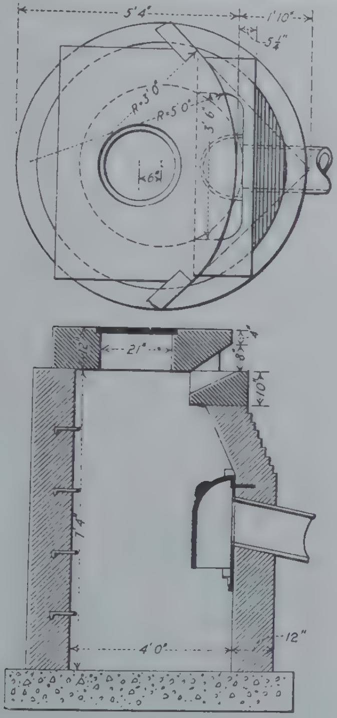


Fig. 25.
Borough of Manhattan, New York.

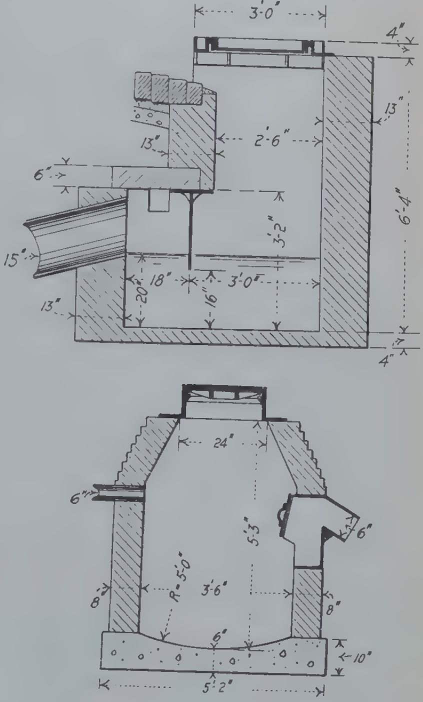


Fig. 26.
Pittsburgh, Pa. (upper)
Seattle, Wash. (lower)

The catch basin used at Providence, described by Mr. Brown, is also of a satisfactory design. The basin is put out of service automatically when it becomes filled with sediment.

The particular feature of this design is the trap, which allows water to pass through until the sediment accumulates to the top of the trap, when the addition of more sediment causes the trap to become filled and the basin to become automatically blocked against the further discharge of sediment or water into the sewer. The shape of the trap also permits water standing above the sediment to be bailed into the trap by the " bottom man," and obviates the necessity of hoisting this water to the street surface.

The standard forms of brick catch basins in use at Indianapolis, Ind., and at Milwaukee, Wis., are shown in *Engineering and Contracting*, January 10, 1912, p. 42, Vol. 37. The Indianapolis basin is 4 ft. 6 ins. in diameter on the inside and has a depth of water of about 3 ft. The Milwaukee basin is about 4 ft. in diameter with a depth of water of a little over 3 ft.

The standard catch basin used in Seattle, Wash., has no direct inlet from the street, but is intended to serve two or more inlets connected by 6-in. pipe. The standard Seattle basin has an interior diameter of 3 ft. 6 ins. and a depth of water below the invert of the outlet pipe of 2 ft. 11 ins. A similar basin, 4 ft. x 2 ft., elliptical in plan, is also built. Both of these structures were described in *Engineering and Contracting*, Vol. 36, July 26, 1911, pp. 101 and 104. The curb inlet is provided with a cast-iron grate, but has no trap or any receptacle for grit.

The standard catch basin adopted for Portland, Ore., is an entirely different design from those previously described. It is shown in *Engineering and Contracting*, Vol. 37, January 10, 1912, p. 42. This is the structure referred to by Mr. Taylor in his description of the work done by the Otterson auto truck. The basin is rectangular in plan, 30 ins. long by 11¾ ins. wide, with a depth of water below the invert of the outlet pipe of about 3 ft. 11 ins. The outlet has no trap. The storm water flows through a heavy curved grating set in the gutter directly over the basin.

Fig. 27 shows the standard type of catch basin and inlet used in Springfield, Mass. The basin is somewhat different from the customary form, in that the sides are constructed on a straight batter from the floor up. No trap is used on either the basin or inlet. The cast-iron frame and cover are of a heavy type. The cover or grate is 20 ins. in diameter and 4½ ins. deep. There are 20 openings, each 1⅛ ins. wide, with a maximum length of 5 ins. There are also openings in the side of the grate, allowing water to pass down between the edge of the grate and the rim of the frame, through the side of the grate into the basin. Blue prints from which this drawing was made were furnished by Frederick H. Clark, superintendent of streets and engineering, Springfield.

In recent years, the use of catch basins has been decreasing, and in its place inlets have been designed to furnish a direct connection between the street and the sewer, either with or without a water-seal trap.

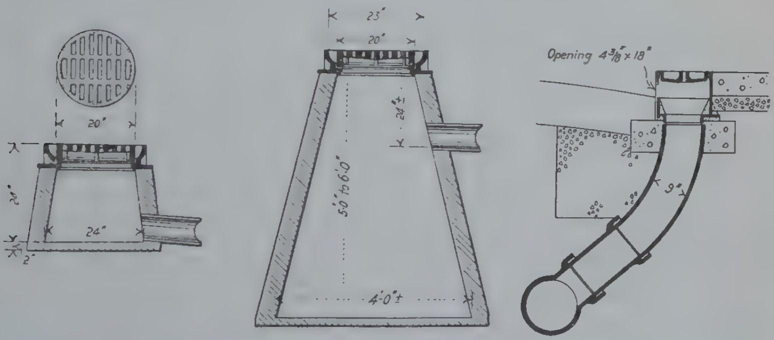


FIG. 27. SPRINGFIELD, MASS. PITTSBURGH, PA.

It is interesting to note that there are no catch basins in Rochester, N. Y. Mr. Edwin A. Fisher, consulting engineer to the city, states that while they have had some difficulties due to the deposit of grit in the older sewers, and have found it necessary to adopt special ordinances for cleaning, on the whole they have had very little trouble from the lack of catch basins. The sewers, as a general rule, have very good grades, and the outlets to the river have free discharge.

Messrs. Rudolph Hering and Samuel M Gray, reporting to the city of Baltimore in 1896 on sewerage and drainage, advised as follows:

"We are also of the opinion that the inlets should not be provided with catch basins to retain the silt or whatever may be washed into them."

Another statement, to be found in the report of the Metropolitan Sewerage Commission of New York for 1914, is as follows:

"Some sewerage systems are without catch basins, and their elimination as a general procedure is much to be desired."

Similarly, in the report of the Commissioners of Sewerage of Louisville, by J. B. F. Breed and Harrison P. Eddy, 1913, there is the following statement:

"Careful consideration was given to the desirability of building inlets rather than catch basins, as had been the city's custom for many years. It was felt, however, that in this climate it was unwise to provide pools of water in which mosquitoes could breed, as is the case where catch basins are built, and further that under existing conditions the catch basins for the retention of detritus were not necessary in most cases. It was also found that it was already the practice of the Board of Public Works to build inlets instead of catch basins. The inlets built have been untrapped, and the experience thus far indicates that this type of inlet has given satisfaction."

Other references of a similar nature including the above, are given in greater detail in "American Sewerage Practice," Vol. I, pp. 520 to 522. Additional opinions might be cited to show that the trend of practice at the present time is towards the elimination of catch basins as far as practicable. There are locations, of course, where the conditions are such as to make it advisable to install catch basins to collect the sediment and prevent its being discharged into low-level sewers constructed on flat grades. In a modern sewerage system, however, where self-cleansing velocities in the sewers are maintained, and where the surfaces of the streets are paved and are kept in a fairly clean condition, it is believed that inlets will be found more satisfactory than catch basins. The cost of an inlet is materially less than that of a catch basin, and consequently it will be possible to provide better drainage for the same cost than as if catch basins were used throughout.

A number of standard types of inlets are shown in the accompanying figures.

The standards adopted by the borough of the Bronx, New York City, are shown in Fig. 28. This figure shows five different types of inlets, one of which is trapped. With inlets of this type there is not so much tendency on the part of the street cleaners to push sweepings into the opening. In dry weather a considerable quantity of such sweepings may be pushed through the opening of the ordinary basin without the condition of the basin becoming apparent, but with the shallow inlet which has but little capacity for sediment, such a practice would soon be noticed and, if continued, the inlet would become clogged before a very material quantity of refuse had been so deposited.

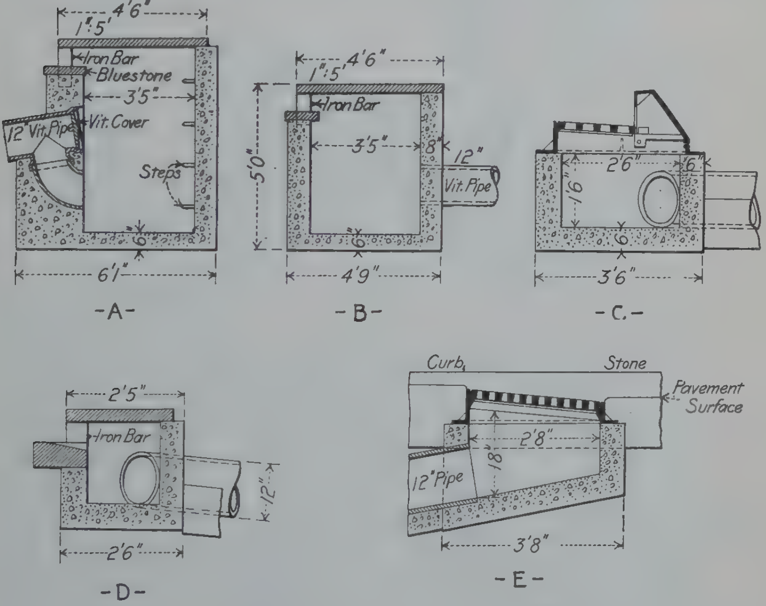


FIG. 28. BOROUGH OF THE BRONX, NEW YORK.

The standard forms of inlet adopted for Philadelphia are shown in Fig. 29, one of which has an opening in the side of the curb and the other a grate in the gutter, through which the water is discharged into the sewer. Both of these inlets are trapped to prevent odors from the sewers reaching the street surface.

A design of inlet used by Metcalf & Eddy is shown in Fig. 30. The cost of this inlet is low, the construction simple and the area of grate opening large. The design shown provides for an 18-in. diameter grate. This can readily be modified as the conditions require, using either a larger or smaller grate for the particular purpose.

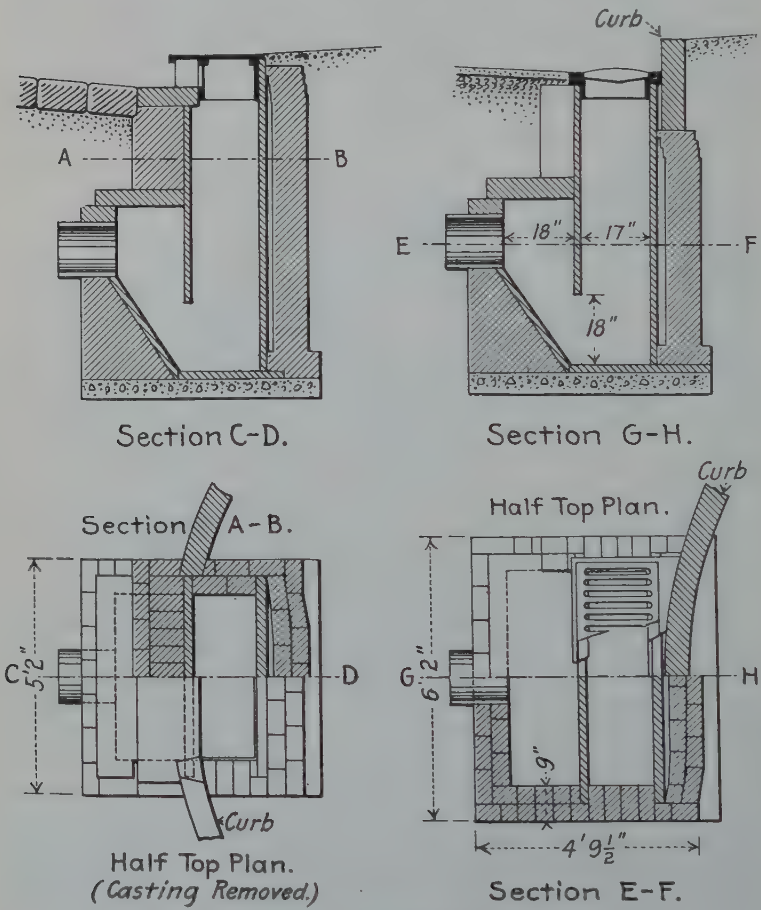
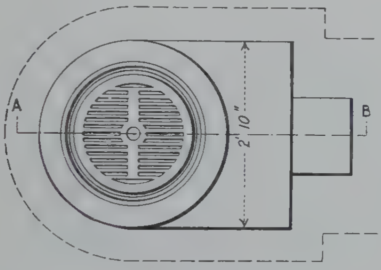
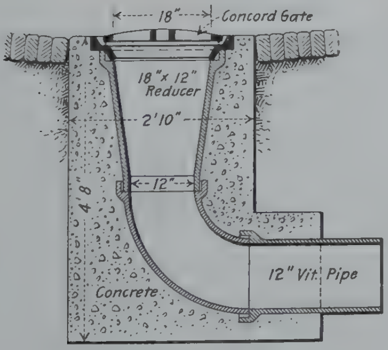


FIG. 29. PHILADELPHIA, PA.

In 1913 and 1915 a number of such inlets were constructed at Hopedale, Mass. The cost in 1915 of the inlets complete, in earth excavation (excluding rock excavation), including pipe and cast-iron grating, was about $46 for a 24-in. inlet and $33 for an 18-in. inlet. This is a considerable saving over the cost of catch basins, which would probably have amounted to $75 to $100 each. The superintendent of streets of Hopedale has had no trouble with these inlets, except when children put sticks down through the grating. These form a dam over the outlet, and in time dirt accumulates back of them and the inlet fills up. Where this occurs, the obstruction can be easily removed. Inlets of a similar type have been in use on a side hill street for twenty-five years, with a catch basin at the foot of the hill. This basin is cleaned out periodically, but none of the inlets along the slope of the hill have required cleaning.



Plan.



Section A-B.

FIG. 30. METCALF & EDDY INLET.

At Baltimore, following the advice of the consulting engineers, inlets were used in the improved sewerage of the city. The inlet is without a sump or collector and the flow passes directly from the street to the sewer or drain. These inlets are described in *Engineering Record*, December 19, 1908, p. 700.

The standard form of inlet used at St. Louis was changed radically in 1915. Both the old form of inlet and the new inlet are described in *Engineering News*, September 30, 1915, Vol. 74, p. 652. The old form of inlet was very similar to that in use at Philadelphia. The new type of inlet allows the water to drop quickly from the gutter to the inlet, on account of the beveled edge given to the sill. This is of importance, especially on side hills, where there is a tendency for the water flowing in the gutter to rush past the inlet and surcharge inlets at the foot of the slope. It is intended to use the trapped type of inlet where the connection is to a sewer on a flat grade, and also where the inlets drain Telford streets on grades steep enough to allow the gravel to wash into the gutters. For all other locations the inlets without traps will be used.

The new designs for curb inlets at Pittsburgh, Pa., published in *Engineering News*, January 27, 1916, p. 156, are of interest. The connection from the street opening to the drain is 9-in. or 12-in. vitrified clay pipe, depending on the type used. A contract for street reconstruction awarded during 1915 included the construction of 313 of these inlets at a contract price, complete in place including concrete and cement filling, of $20 per inlet. The inlets are located about 40 ft. apart along the curb line, and discharge into a 12-in. pipe laid about 5 ft. under the surface of the street. The collecting drains discharge into special trapped manholes leading to the combined sewers. The manholes are trapped to prevent the escape of odors or steam in the combined sewer.

Cleaning Catch Basins.

Careful records are kept at Worcester, Mass., to show the cost of cleaning the catch basins. Some of these data, taken from the annual reports of the superintendent of sewers, are shown in Table 7. Each basin is cleaned by two men, one a

TABLE 7.

DATA REGARDING CLEANING OF CATCH BASINS AT WORCESTER, MASS.

(Taken from Annual Reports of Supt. of Sewers.)

Year Ending Nov. 30.	Total Number of Catch Basins in System.	Number of Cleanings during the Year.	Av. Amount of Material Removed per Cleaning.†	Av. Amount of Material Removed per Basin per Year.	Cost of Cleaning per Cu. Yd. Deposit Removed.*	Cost of Removing Material per Catch Basin per Year.*	Minimum Wage for Labor — 8 Hours.
1905	2 748	....	...	7.5	$0.41	....	$1.85
1906	2 818	4 652	3.93	6.5	0.57	$3.69	1.85
1907	2 902	4 804	3.04	5.1	0.81	2.48	1.85
1908	3 014	5 053	2.72	4.6	0.81	2.20	1.85
1909	3 138	5 142	2.43	4.0	0.80	1.94	1.85
1910	3 251	6 094	2.45	4.9	0.74‡	1.82	1.85
1911	3 322	7 035	2.35	5.1	0.69	1.65	1.85
1912	3 413	6 783	2.56	5.1	0.83	2.13	2.00
1913	3 507	8 014	2.36	5.4	0.80	1.89	2.00
1914	3 563	5 522	2.65	4.1	0.82	2.18	2.00
1915	3 746	6 095	2.43	4.0	0.82	1.95	2.00

* Includes cost of teams, labor removing refuse from basins, all inspection and looking after clogged and frozen traps.

† Based on haul at rate of 1⅛ cu. yd. per load to 1909 inclusive, after that date, 1½ cu. yd. per load.

‡ Began using Watson dumping wagons in place of tip carts. Length of haul gradually increasing.

The unit costs of thawing and freeing traps per year per basin in service varies from 21c. to 47c.

One of the strong arguments for constructing catch basins is that it is cheaper to clean the sediment from the catch basin than it is to remove it from the sewer. In this connection it is interesting to compare the cost of sewer cleaning at Worcester, Mass., with the cost of cleaning catch basins for corresponding years. These data are shown in Table 9. The unit costs of cleaning sewers, based on the cubic yards of deposits removed for the years 1906 to 1914, inclusive, varied from $4.56 to $8.26 per cu. yd. of deposit removed, exclusive of the cost of flushing sewers; and with flushing included, the cost of cleaning per cubic yard of deposit removed varied from $5.50 to $9.74.

For comparison with the above, the cost of removing the deposit from catch basins as per Table 7 varied from $0.41 to $0.83 per cu. yd. It is evident that if material is allowed to enter the gutter openings with the certainty of being deposited at some point in the drainage system, it is more economical to remove the deposit from catch basins than from the sewers.

If, on the other hand, the catch basins collect material which would have been carried along in the drainage system without being deposited, the basins become a source of expense that is not justified. Under such circumstances the basins should be replaced by inlets.

From the figures given in Table 7 it is assumed that the annual cost of cleaning a catch basin is $2.00. In all probability, the catch basin could be replaced by an inlet for an expense not exceeding $50 to $75. The annual expenditure of $2.00, allowing interest at 4 per cent., represents an investment of $50. Thus in one to two years' time would be saved the cost of replacing the catch basin with a suitable inlet involving practically no further charges for cleaning. The character of the street surface or pavement and the method of street cleaning are two factors which strongly influence the question of the use of catch basins. Even where smooth, hard pavements such as wood block or asphalt are laid, and it would at first thought appear unnecessary to provide for catching grit, such provision is necessary at times because of the practice of sanding the pavements on rainy days to make them less slippery. Sand, stone and brick dust and other solid materials fall from passing carts in appreciable quantities where traffic is heavy. Such material will be washed into the drains during sudden showers in spite of all care in street cleaning.

Where paved streets are cleaned by flushing, a large quantity of detritus will be washed into the drains. There may be some question as to whether it is more economical to remove such material from the catch basins and drains after street flushing, or to sweep the streets and gather the detritus up from the gutters. Street sweepers seem to have acquired a reputation for pushing sweepings into basins and inlets, so that either method of cleaning may result in detritus being discharged into the drains, either by design, accident or otherwise.

One factor which has tended to produce unsatisfactory results, as regards the construction and maintenance of catch basins in many cities and towns, is the lack of coöperation between the various departments having in charge the design, construction and maintenance of the basins. If all of this work could be under the general supervision of one official, much better conditions might prevail. In many cities there is no adequate inspection of the basins and no regularity or system of cleaning. Oftentimes such basins are worse than useless, as they become filled, create objectionable odors and permit a large quantity of material to be discharged into the sewers in time of storm.

In the opinion of the writer, the results of the discussion may be summarized as follows:

1. Where combined sewers or drains are laid on very flat grades, not providing self-cleaning velocities, catch basins are useful to catch detritus in order that it may be removed more economically than from the sewers or drains.

2. A considerable saving in the cost of cleaning catch basins can be effected by the use of a suitable motor-truck equipment.

3. Of the two examples of motor-truck apparatus described, that developed by Mr. Carpenter appears to meet the conditions in New England cities where the Otterson machine failed, although successful in the West.

4. Where self-cleansing velocities can be obtained in the

drainage system, from the surface connections through to the point of discharge, inlets without traps should be built in preference to catch basins, both for economy and better service.

It may be more economical to construct a single catch basin in the main drain at the head of a section laid on a very flat grade rather than to build catch basins for a large number of surface connections.

5. Oil should be applied to the water in catch basins, to prevent the breeding of mosquitoes.

6. Catch basins should be regularly inspected and should be cleaned after each severe storm if necessary.

7. Catch basins should be built only where necessary, because of special conditions, and not as a matter of custom, as appears to be the practice in some cities.

8. Unless catch basins are actually catching grit, which would otherwise be deposited in the sewer or drain, they should be replaced by inlets.

Figs. 21 to 30 inclusive were from the following sources:

Fig. 21. Catch basin, Columbus, Ohio.
From " American Sewerage Practice, Vol. I — Design of Sewers."
McGraw-Hill Book Company, Inc.
Fig. 22. Catch basin, Newark, N. J.
From " American Sewerage Practice, Vol. I — Design of Sewers."
McGraw-Hill Book Company, Inc.
Fig. 23. Concrete catch basin, borough of the Bronx, New York.
From book of standards published by the city.
Fig. 24. Brick catch basin, borough of the Bronx, New York.
From book of standards published by the city.
Fig. 25. Catch basin, borough of Manhattan, New York.
From " American Sewerage Practice, Vol. I — Design of Sewers."
McGraw-Hill Book Company, Inc.
Fig. 26. Catch basin, Pittsburgh, Pa.
From book of standards published by the city.
Fig. 27. Inlet and catch basin, Springfield, Mass.
Fig. 28. Inlets, borough of the Bronx, New York.
From " American Sewerage Practice, Vol. I — Design of Sewers."
McGraw-Hill Book Company, Inc.
Fig. 29. Inlets, Philadelphia, Pa.
From " American Sewerage Practice, Vol. I — Design of Sewers."
McGraw-Hill Book Company, Inc.
Fig. 30. Inlet, Metcalf & Eddy.
From " American Sewerage Practice, Vol. I — Design of Sewers."
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* Asst. Librarian, Boston Society of Civil Engineers.

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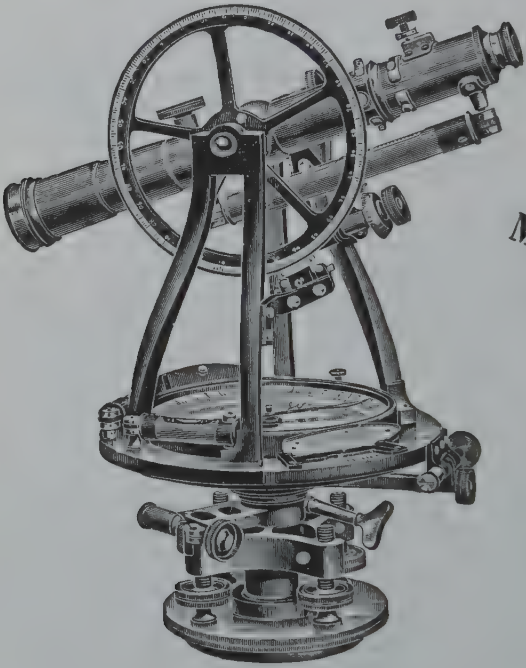

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